Vol. XVI No. 3

DISSERTATION ABSTRACTS

ABSTRACTS OF DISSERTATIONS AND MONOGRAPHS IN MICROFORM

UNIVERSITY MICROFILMS
ANN ARBOR, MICHIGAN: 1956

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INTRODUCTION

This year for the first time *Dissertation Abstracts* will carry, as the 13th issue of Volume XVI, an index to all doctoral dissertations published in the United States and Canada. This issue will be titled *Index to American Doctoral Dissertations*, and will be a continuation of *Doctoral Dissertations Accepted by American Universities.*[1] The joining of these two reference works makes it possible for librarians to have an integrated bibliographical research tool relating to doctoral dissertations under one cover.

Dissertation Abstracts will continue to provide abstracts of dissertations by recipients of doctoral degrees from graduate schools cooperating with University Microfilms in the publication of complete dissertation texts on microfilm, on Microcards, or as microprint. At the end of each abstract will be found an indication of the number of pages in the original typescript and the Library of Congress card number, for the convenience of scholars and research workers. In some instances *Dissertation Abstracts* will be found to be an adequate substitute for the published dissertations.

The *Index to American Doctoral Dissertations* will be a complete indexed listing of dissertations by students who were granted doctoral degrees during the previous academic year, and including those abstracted in *Dissertation Abstracts*, arranged by degree-granting institutions under appropriate subject headings. An alphabetical author index will be included.

The tabular material which has been an established part of its predecessor volume will be included in full, so arranged that statistical summaries can be maintained with no break in continuity.

It is hoped that those who use *Dissertation Abstracts* will continue to make suggestions for its improvement, as these are vital to its continued life and growth. Several suggestions for changes in the headings used for indexing purposes have been received, and a committee of the Association of Research Libraries is reviewing the indexing system at the present time as a result of these suggestions.

[1] Arnold H. Trotier and Marian Harman, (eds.), *Doctoral Dissertations Accepted by American Universities.* (New York: H. W. Wilson Co., 1933-1955.)

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TABLE OF CONTENTS

The Table of Contents lists in alphabetical order the principal subject headings of the dissertations abstracted. For the convenience of readers an alphabetical author index is included following the abstracts.

AGRICULTURE, GENERAL

THE PROTEIN STABILITY AND WETTABILITY OF MILK POWDER AS AFFECTED BY CHANGES IN MILK COMPOSITION

(Publication No. 15,651)

Diptiman Chakravarti, Ph.D.
State College of Washington, 1955

When dried milk is used for beverage purposes, the flavor and wettability of the product is considered to be of prime importance. Often, however, the destabilization of milk protein restricts the treatment or necessary changes in milk composition which might give better flavor and higher wettability to the resultant milk powder. This study was undertaken to gain information on the protein stability and wettability of the milk powder as affected by changes in milk composition.

The protein, carbohydrate and fat concentration, as well as the mineral balance of the milk was changed before drying by various means. The effect of the changes of heat treatment, addition of the antioxidant nordihydroguaiaretic acid, and addition of the emulsifying (and solubilizing) agents polyoxyethylene stearate and carboxymethyl cellulose on protein stability and wettability of the resultant milk powder were also investigated. The term "protein stability" refers to the percentage of the total protein of the milk powder sample which is soluble in 50 per cent alcohol. The wettability refers to the degree of wetting expressed in percent of milk powder that was immediately dispersed in water without agitation. The protein stability and initial wettability of the powder was determined on the day following the manufacture and wettability was also determined after storage for 6 months at 45° and 85° F.

The addition of relatively large amounts of isolated casein in the form of a sodium caseinate sol improved the protein stability and reduced the wettability of the resultant spray-dried powder. The addition of lactose or sucrose was found to elevate the protein stability and wettability of the resultant powders. When lactose was added as whey, the wettability of milk powder stored at 45° and 85° F. was noticeably improved but protein stability was markedly lowered. Dialyzation of milk improved protein stability but lowered wettability of the resultant powder. The addition of carboxymethyl cellulose (0.5 per cent of the total solids of milk) to milk with lactose, sucrose or a mixture of both had no improving effect on the protein stability and wettability of the resultant powder. Mineral ion-exchange treatment of milk to replace a part of the calcium with sodium increased the protein stability but had no improving effect on wettability. Addition of calcium chloride to milk greatly diminished the protein stability of the resultant powder with no appreciable effect on wettability. Preheat treatments of the milk from 200° -205° F. for 5 minutes, elevated and 160° F. for 5 minutes lowered the protein stability of the resultant powder as compared to normal preheating at 170° F. for 20 minutes, but had no appreciable effect on wettability. The addition of polyoxyethylene stearate (0.1 per cent of the original milk) did not have any appreciable effect on either the protein stability or wettability of the resultant powder. The addition of sucrose to heavy cream was found to produce a high protein stability of the resultant dried cream. Blending of dried skim and dried heavy cream produced a resultant product of high protein stability and low wettability. Blending of dried skim milk with or without lactose added and dried high fat cream with nordihydroguaiaretic acid added (0.5 per cent of fat content of the cream) produced a product with high protein stability and low wettability.

The correlation between protein stability and calcium content of the milk powders was found to be significant ($P<0.05$); however, no statistically significant correlation was found between protein stability and the following:

(a) Wettability after storage for 6 months at 45° F. or 85° F.

(b) Moisture, fat or carbohydrate content.

The correlation between wettability at 45° F. and wettability at 85° F. storage for 6 months was found to be significant ($P<0.01$). There was also a significant ($P<0.01$ correlation between wettability after storage for 6 months at 45° or 85° F. and fat or carbohydrate content of the powders. No statistically significant correlation was found between wettability after storage for 6 months at 45° or 85° F. and moisture or calcium content of the powders. Significant ($P<0.01$) correlation was found between moisture and fat content of the powder. The correlation between the moisture and carbohydrate content of the powders was statistically not significant. 86 pages. $1.08. Mic 56-652

THE SOURCES OF NITROGEN AND THE OXIDATION-REDUCTION POTENTIAL AS THEY APPLY TO MOLD GROWTH

(Publication No. 15,657)

Mounir Ramzi Nagmoush, Ph.D.
State College of Washington, 1955

A study was undertaken to determine the growth of four common molds, namely Aspergillus niger van Tieghem, Geotrichum candidum link ex Loubiere, Penicillium roqueforti Thom, and Penicillium notatum Westling in a modified Czapek solution to which various sources of organic (peptone, tryptone and proteose-peptone) and inorganic nitrogenous compounds (KNO_3, NH_4Cl and $(NH_4)_2HPO_4$) were added. In addition the growth was studied under various cultural conditions; namely, the use of filtrate from a previous growth, the change in the concentration of the substrate and the use of different initial pH's standardized with an organic acid (citric) or an inorganic acid (hydrochloric). The practice of cultivating molds as pads in liquid media was used. Additional experiments for comparing

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

growth on solid media were conducted by adding 1.5 per cent agar to the liquid media. Growth was then determined by measuring the diameter of the colonies. The data presented show the following:

1. At pH 6.5 the organic nitrogen compounds were preferentially utilized over the inorganic nitrogen compounds by all molds.
2. Under additional cultural variations the inorganic nitrogen (N) compounds proved better for growth with the one exception of A. niger which favored the organic N at pH 2.5.
3. Each particular mold exhibited distinctive physiological and morphological characteristics on each medium in which it grew, showing a differential use of salt ions, organic and inorganic nitrogen.
4. The marked preference for KNO_3 as the N source by P. notatum and to a less extent by P. roqueforti may have commercial significance. However, KNO_3 inhibited the growth of G. candidum.
5. The change in the reaction of the medium was greatly influenced by the nitrogen source. The final pH was varied, depending upon the organism involved and to a lesser extent upon the initial pH of the media. The type of acid used to establish the initial pH was also significant.

Based on these experiments the effects of growth of the test organisms on the oxidation-reduction potential (Eh) and the H-ion concentration were determined. Measurements of Eh and pH were recorded every 24 hours for a period of two weeks. To reduce the number of experiments only the nitrogen sources, KNO_3, NH_4Cl and tryptone were used. The results show the following:

1. The magnitude of the change in oxidation-reduction potential of the fungi studied, varied with the organism and with the nitrogen source.
2. The oxidation-reduction potentials of the media were lowered in all cases during the initial period of vegetative growth of the fungi.
3. A. niger proved to be the most uniform in its effect on the media with regard to the intensity of the Eh reduction; with the media used the minimum Eh level established by this organism was always around 200 millivolts.
4. G. candidum produced different effects on the oxidation reduction potentials of the different media. Fluctuations in Eh readings in the tryptone medium were accompanied by changes in macroscopic morphology of the organism.
5. P. roqueforti and P. notatum produced the greatest reduction of Eh levels of the media in most cases. In the KNO_3 medium they shifted the pH toward neutral at the end of the incubation period and tended to do so in the tryptone medium.
6. The Eh changes produced by the fungi in the culture media did not appear to have any direct relationship with pH changes. 123 pages. $1.54. Mic 56-653

THE EFFECT OF MECHANICAL COMPOSITION AND CLAY MINERAL TYPES ON THE MOISTURE PROPERTIES OF SOILS

(Publication No. 15,762)

Lewis H. Stolzy, Ph.D.
Michigan State University, 1954

A study was made on the moisture characteristics of thirty-eight Michigan soils. Moisture properties were determined on cores and bag samples taken from each horizon. Field capacity measurements were made on the different horizons after they were artificially saturated and allowed to free drain for 36 to 48 hours.

The soil cores were taken into the laboratory and various tensions from 0 to 1 atmosphere were determined on the tension table and by the porous plate method. Tensions from 3 to 27.19 atmospheres were determined on less than two millimeters air dry samples taken from the different horizons. The pressure-membrane apparatus was used for these determinations. Moisture equivalents, mechanical analyses and wilting point determinations were also made on the soil samples.

The Norelco X-ray Spectrometer was used to determine the types and amounts of clay minerals present in the soil clays. Montmorillonite, illite and kaolinite were present in Michigan soils. Illite predominated in most horizons. Kaolinite was generally present in the different horizons in varying amounts. Montmorillonite was the least common in the different horizons with twenty percent being the largest amount present in any one horizon.

The data for the various horizons for each soil were tabled and the moisture release curves for these horizons were drawn. The field capacity, moisture equivalent and the wilting point were indicated on the release curves. The drop in moisture tension values from 1 to 3 atmospheres especially on the A_p horizon indicated that soil structure is still a factor to be considered in moisture studies above 1 atmosphere.

The relationship of field capacity to moisture equivalent, to 0.06 atmosphere tension and to 0.33 atmosphere tension were studied. Similar relationships for field capacity and moisture equivalent were found for Michigan soils as were found by other investigators for soils in different parts of the country. Samples with field capacity values below 12 percent have a much lower moisture equivalent. Those from 12 percent to 22 percent moisture equivalent approach field capacity but are still lower. Samples with above 22 percent moisture equivalent have lower field capacities. The 0.06 atmosphere tension is the best measure of field capacity on samples below 12 percent moisture while a tension between 0.06 atmosphere and 0.33 atmosphere would be the best measure of field capacity above 12 percent.

The permanent wilting percentages were determined on the stems of tomato plants. These percentages were then compared with the 5, 8 and 15 atmosphere tensions. The permanent wilting percentage approached most nearly the 5 atmosphere tensions with the line of best fit falling between the 5 and 8 atmospheres tension.

The percent of available water in the different soil horizons varied from 4 to 16 percent moisture on surface soils when the clay content of the soil sample was less than 28 percent. This decreased with higher percentages of clay. Subsurface samples had from 4 to 10 percent available

moisture when the clay content of the soil sample was less than 18 percent. While subsurface samples with clay contents higher than 18 percent decreased in available water with increasing percentages of clay.

142 pages. $1.78. Mic 56-654

AGRICULTURE, ANIMAL CULTURE

STUDIES ON THE PREVENTION OF A PEROSIS-LIKE CONDITION IN TURKEYS INDUCED BY AN ISOLATED SOYBEAN PROTEIN

(Publication No. 15,654)

John Robert Hunt, Ph.D.
State College of Washington, 1955

Feeding a purified diet containing an isolated soybean protein was found to induce enlarged hocks (perosis) in turkey poults. This dissertation reports a series of investigations concerned with: (1) the cause of this abnormality and its prevention in the turkey poult and (2) the relation of diet and hock enlargement in young poults to the development of leg weakness in maturing turkeys.

The occurrence of enlarged hocks in turkey poults was found to be due to the inclusion of an isolated soybean protein (Drackett protein 220) in the purified diet. Feeding the basal poult diet or this diet with high levels of the isolated soybean protein did not induce the enlarged hock disorder in chicks.

Replacement of the isolated soybean protein with soybean oil meal prevented the development of the enlarged hocks. Similar prevention was obtained when the Drackett protein 220 was washed with water. Feeding a concentrate of the washing was ineffective in producing enlarged hocks.

Increasing the vitamin content of the purified diet 15 fold prevented hock enlargement in turkey poults. No specific vitamin or group of vitamins could be found to be as effective in preventing the disorder as supplementing the diet with a 15 fold increase of all the vitamins. However, in one experiment the addition of all the B complex vitamins at the high level prevented the disorder while the fat soluble vitamins failed to alleviate the condition.

The occurrence of enlarged hocks in young poults did not cause the development of leg weakness in maturing turkeys. The incidence of leg weakness in mature turkeys could not be enhanced by nutritional variation in these studies.

69 pages. $1.00. Mic 56-655

REPRODUCTIVE BEHAVIOR OF THE DAIRY GOAT, Capra hircus, UNDER PUERTO RICAN CONDITIONS

(Publication No. 15,867)

Reynaldo A. Nadel-Grau, Ph.D.
The Ohio State University, 1955

Observations and experiments were conducted to investigate the reproductive behavior of both the buck and the doe under Puerto Rican conditions. The goat herd of the Lajas Agricultural Substation (University of Puerto Rico) was used to obtain the data.

The goat semen characteristics observed were: volume, 0.96 ± .453 cc; color, varied from very light yellow to greenish yellow; concentration, 1,635,000 ± 699,800 sperm per cu. mm.; longevity of sperm in diluted sample kept at 40° F, 5.1 ± 1.664 days. The initial motility was either excellent or very good in most of the samples studied, but it decreased rapidly after the first 24 hours of storage. The total length of the spermatozoon is 59.0 ± 1.245 micra. The head length is 8.74, and the tail 50.26 micra. The morphology is very similar to that of the ram sperm and also of the bull. Goat sperm were found at the anterior extremity of the horns of the uterus 35 minutes after copulation.

No association was found between volume of ejaculate and concentration of sperm nor between age of buck and concentration. The season of the year appears to have no significant effect on volume of the ejaculate, but sperm concentration was found to be significantly higher at the peak of the breeding season (September) than 3 months before and after that time.

Buck kids reach puberty between 3 1/2 to 4 months of age, but signs of libido are exhibited at an earlier age. The lowest ratio in services required per conception was 1.08, obtained in November. The period June-January was observed to be more fertile than the rest of the months of the year. The over-all mean for the whole year was 1.26 services per conception.

In connection with the doe, the most reliable heat symptom was her behavior toward the buck. The duration of estrus was 33.80 ± 8.95 hours, with a range of 8 to 72 hours. The duration of the estrual cycle was 25.30 ± 12.12 days, with a range of 6 to 81 days. The duration of estrus seems to be more affected by climatic factors than the duration of the estrual cycle. Estrus does not seem to have a significant effect on milk production. The average age of puberty, determined from the exhibition of definite signs of estrus, was 5 months, but some doelings may show these signs much earlier. The breeding season extends, in general from June to November, September being the month of greatest sexual activity. The length of gestation was found to be 147.35 ± 4.31 days, with a range of 132 to 160 days. The number of offspring per parturition and the age at kidding time had no significant influence upon the length of gestation. Older does have a tendency to be more prolific than younger ones. The greatest fecundity occurs at about 5 years. The frequency of single and multiple births was as follows: 1 - offspring, 36.0 per cent; 2, 51.7 per cent; 3, 11.0 per cent; and 4 - offspring, 1.1 per cent. The average interval between parturition and first estrus during the breeding season was 29 days, and during the remaining six months, 86.67 days. Although pseudo and true hermaphrodites are common among goats, no such animals were observed in this herd. The number of offspring per parturition and sex have a significant influence upon weight at birth, singles and males being heavier. The average weight of newly born kids, regardless of number per parturition or of sex, was 4.88 pounds.

The reproductive organs of the doe are very similar to those of the cow and almost identical with those of the ewe. Does ovulate approximately 30 to 40 hours after the onset of estrus. They should be mated on their second day of heat in order to increase the chances for conception.

102 pages. $1.28. Mic 56-656

THE ROLE OF ANTIBIOTICS IN MODIFYING THE ENERGY, VITAMIN, AND PROTEIN REQUIREMENTS OF CHICKS

(Publication No. 15,659)

Rollin Harold Thayer, Ph.D.
State College of Washington, 1955

To establish the role of antibiotics in modifying the energy, vitamin, and protein requirements of chicks, a cerelose-soybean meal basal diet which gave a growth response equal to that obatined with a practical broiler diet was developed. The cerelose-soybean meal basal diet was formulated in such a way that the protein, vitamin, and energy levels could be varied singly or in combination over a wide range. A series of experimental diets which were deficient in protein, vitamins, and energy were made by modifying this cerelose-soybean meal basal diet. The experimental diets with and without the addition of penicillin were fed to chicks. The growth response which was obtained was compared to that obtained with chicks fed an adequate control diet.

The growth-promoting ability of these deficient diets was improved by the addition of penicillin. These results indicated that penicillin increased the efficiency with which protein, vitamins, and energy were utilized by the growing chick.

In order to study the problem of protein utilization more in detail, a series of metabolism trials were conducted. A chemical separation technique was used to separate and measure urinary and fecal nitrogen. From these data, the percentage of dietary protein nitrogen excreted as apparent true protein nitrogen in the feces, the percentage of absorbed dietary protein nitrogen retained in the chick's body, and the percentage of absorbed dietary nitrogen excreted as urinary nitrogen were calculated. Penicillin feeding increased the percentage of dietary nitrogen which was absorbed from the digestive tract and reduced the percentage of absorbed dietary nitrogen which was excreted as urinary nitrogen.
tary nitrogen which was excreted as urinary nitrogen.

Digestion studies were conducted in vitro using an enzyme homogenate prepared from the small intestines of growing chicks. It was apparent from these studies that penicillin increased the rate of enzyme activity per gram of intestinal weight, although the differences were not statistically significant. This increased enzyme activity was definitely established within 24 hours after the penicillin was introduced into the diet.

129 pages. $1.61. Mic 56-657

AGRICULTURE, FORESTRY AND WILDLIFE

SOME EFFECTS OF VEGETAL COVER UPON THE HYDROLOGY OF WATERSHEDS AT EAST LANSING, MICHIGAN

(Publication No. 15,760)

James LeRoy Smith, Ph.D.
Michigan State University, 1954

Two small watersheds at East Lansing, Michigan were compared on the basis of 11 years records. One watershed was forested, the other cultivated. The watersheds were compared as to differences in soil moisture, physical soil differences, soil losses and surface run-off. A further comparison was made between the wooded watershed while forested, and for the first year after a commercial clear cut.

Soil moisture at the wooded watershed was found to be consistently higher than that found at the cultivated watershed. This was due to the higher absorptive qualities of the wooded watershed soils. Both retention and detention storage were higher for the wooded watershed soils. Organic content was higher, volume weights lower and saturation point higher for the wooded soils.

The cultivated watershed lost a large amount of winter precipitation to surface run-off, while the wooded losses were insignificant. Cultivated losses were due to rain and snow melt on frozen soil. The wooded soils were seldom observed in a frozen state, while the cultivated soils were frozen for most of the first three months of the year.

As a result of the clear cut on the wooded watershed, soil moisture for the first year following the cut was higher than usual. This high moisture content of the soil was due to lessened use of water caused by removal of most of the vegetation on the area. This high moisture was the cause of a run-off in August 1952. This was the second run-off in August for the period of study — 12 years. The first run-off was caused by an abnormal rainfall for the entire year. The 1952 run-off occurred in spite of a rainfall of 10 inches less than that registered for the year of the first run-off.

The cultivated watershed lost over 50,000 pounds of soil per acre in an eleven year period. In the same time, wooded watershed erosion losses were only 62.0 pounds of soil per acre. The cultivated watershed lost 13 percent of yearly precipitation to run-off, the wooded lost only 1.7 percent.

Storms for the eleven year period were classified as to intensity class. High intensity storms were found to occur during the period from May to September. Low intensity storms were found to be statistically significant in producing run-off on the cultivated, but not the wooded watershed.

Soil and air temperatures on the wooded watershed for year preceeding the cut and the year following the cut showed a change due to vegetation removal. Air temperatures at 2.5 feet elevation above the forest floor were more nearly equal to those at 4.5 feet elevation in a field outside the forest, after the cut. Winter minimum temperatures were lower after the cut than before. Summer maximum temperatures were higher after the cut than before.

158 pages. $1.98. Mic 56-658

AGRICULTURE, PLANT CULTURE

THE PHYSICAL CONDITION OF PUTTING-GREEN SOILS AND OTHER ENVIRONMENTAL FACTORS AFFECTING THE QUALITY OF GREENS

(Publication No. 14,442)

Richard Richardson Davis, Ph.D.
Purdue University, 1950

Major Professor: G. O. Mott

The greenkeepers on eight golf courses were asked to point out the putting green on their course that could be maintained in good playing condition with the least amount of attention. The greens so chosen will be referred to as the "best" greens. Likewise each greenkeeper was asked to point out the most troublesome green on his course, and those greens will be referred to as the "poorest" greens. Soil samples were taken in two locations from the "best" green and the "poorest" green on each course. Studies were made of the physical and chemical condition of the soils and any other factors thought to influence the quality of the greens.

The saturated percolation rate under 75 cm of water tension was studied with "undisturbed" soil cores 3 inches in diameter and 8 7/16 inches long. The rate of percolation through cores from the "best" and "poorest" greens did not differ significantly; however, the tendency was for faster percolation rates in the "best" greens. The quantity of water removed from these large cores when saturated and drained under tension was measured. More water, which represents large pore space, was removed from the "best" greens than from the "poorest" greens.

The moisture content of the soil cores after draining was affected by layers in the cores. Moisture curves were very erratic, but the curves for the "poorest" greens were usually more erratic than "best" greens.

When large or aeration pore space was measured with samples taken in cans 3 inches in diameter and 2 inches deep, no difference was found in the "best" and poorest" greens. Less aeration pore space was found within 3 1/2 inches of the surface than below this depth. Organic matter and large pore space were negatively related. Coarse sand (0.25 - 2.0 mm.) was positively correlated with large pore space.

Both percent total pore space and organic matter were higher in the "poorest" greens than in the "best" greens. Organic matter and total pore space had a close positive correlation. Volume weight was closely negatively correlated with organic matter.

The moisture tension of the soils at the time of sampling was approximately pF 2. The percent moisture was closely related to small pore space.

The texture of the putting-green soils was usually a poorly mixed sandy loam. No definite conclusions could be drawn as to the effect of particle sizes on the quality of greens.

The "best" greens had a better root system than the "poorest" greens. No conclusions could be drawn as to the effect of layers on the distribution of roots.

As a rule, the "best" greens were more favorably located for good air circulation than the "poorest" greens. More trees are found around the "poorest" greens, and tree roots are prevalent in these greens.

The soil reaction varied from slightly acid to slightly alkaline. In the "best" greens the pH was higher than in the "poorest" greens. It is also higher in an area 4 to 8 inches from the surface than an area 1 to 4 inches from the surface.

Phosphorus was very high while potassium was low in most greens. The phosphorus and potassium content were positively correlated. Both phosphorus and potassium were higher near the surface than they were 4 to 8 inches down. Both were also higher in the "poorest" greens than in the "best" greens. 117 pages. $1.46. Mic 56-659

THE YIELD AND COMPOSITION OF ALFALFA AS MODIFIED BY FREE LIME IN THE SOIL

(Publication No. 14,962)

William Hamilton Longstaff, Jr., Ph.D.
University of Missouri, 1955

Supervisor: William A. Albrecht

This study was conducted to determine (1) the several effects of free calcium carbonate in the soil and (2) the effect of various magnesium and potassium saturation levels of the colloidal clay in the soil on the growth and chemical composition of alfalfa plants. The various interactions of free lime and magnesium, of free lime and potassium, and of magnesium and potassium are also considered.

This greenhouse investigation consisted of growing alfalfa plants in sand-colloidal clay cultures whereby four levels of magnesium and three levels of potassium were employed. All the other essential nutrients were applied in constant amounts. In the Neutral series the colloidal clay cultures were 100 per cent saturated with bases; while in the Free-lime series an additional 7.5 per cent calcium carbonate was added. The plants were grown for a period of 283 days; a period of six cuttings. Chemical analyses for calcium, potassium, sodium, magnesium, phosphorus, nitrogen, manganese and iron were determined.

The free lime had an appreciable effect on the individual cuttings and total uptake of calcium, sodium, phosphorus, nitrogen, and manganese in the alfalfa. The total growth and total uptake of potassium, magnesium, and iron in the crop were not affected by the addition of free calcium carbonate to the cultures. The various magnesium saturations of the cultures only affected the total uptake of magnesium, manganese, and iron; while various potassium saturations of the cultures affected the total growth, and the total uptake of calcium, potassium, phosphorus, nitrogen, and iron. In conjunction with the above effects numerous interactions of free lime and potassium were noted. This was not the case with the free lime and magnesium interactions.

Thus this liberal amount of calcium pointed to the importance of the ratios of the degrees of calcium saturation of the colloidal complex of the soil to the degrees of saturation of it by magnesium and potassium, especially the latter. This study also points to the basic play of the exchangeable cations and active anions in the soil as these determine the nutrients mobilized into the crop for the physiological processes and subsequent control of plant yield and composition.
150 pages. $1.88. Mic 56-660

STUDIES ON THE NATURE OF PATHOGENICITY OF X. PHASEOLI (E. F. SM.) DOWSON AND OF X. PHASEOLI VAR. SOJENSIS (HEDGES) STARR AND BURK.

(Publication No. 15,520)

Roy Leonard Millar, Ph.D.
Cornell University, 1955

The specificity of pathogenicity of Xanthomonas phaseoli and X. phaseoli var. sojensis was determined by cross-inoculation studies performed on Red Kidney bean and soybean. X. phaseoli was found to be pathogenic only on Red Kidney bean. The soybean pathogen caused infection of both plant species but the severity of the infection on Red Kidney bean was conditioned by the degree of injury sustained by the plant cells during inoculation. Passage of both pathogens through tissues of soybean stems did not alter the pathogenic properties of either organism.

Both Red Kidney bean and soybean were examined for the presence of substances that would inhibit growth by isolates of both pathogens. Seeds, cotyledons, stems, and leaves were tested by various methods for their inhibitory properties. No evidence was obtained to indicate that the restricted pathogenicity of the two pathogens might be explained on the basis of specific antibiotics present in the plant tissues.

The capacity of both pathogens to grow and to produce pathogenic cells in a synthetic basal medium consisting of glucose and inorganic salts was studied. Both pathogens possessed the capacity to grow in the basal medium providing the initial pH level of the medium was above pH 5.8-6.0. At pH levels below pH 5.8, visible growth by the pathogens was not observed although the cells retained their viability throughout comparatively long incubation periods. The optimum pH level for growth was found to be in the range 7.0-7.5. Growth in the basal medium resulted in the production of pathogenic cells by both organisms.

Studies employing supplemented and nonsupplemented basal medium indicated that the effect of low pH levels on growth by the two pathogens was to prevent the synthesis of metabolites essential to the growth of the organisms. Evidence was obtained that strongly supports L (+) glutamic acid as being the metabolite involved.

Although yeast extract supplemented basal medium supported abundant growth of X. phaseoli var. sojensis (XPS 25) at all pH levels employed, the cells produced in yeast extract medium varied greatly in their pathogenic properties depending on the initial pH of the growth medium. The extent of the variation ranged from avirulent at pH levels of 5.0 through highly virulent at pH levels of 6.8.

Studies employing penicillin showed that X. phaseoli var. sojensis (XPS 25) exhibits either susceptibility or resistance to the inhibitory action of penicillin depending on the pH level of the growth medium. The nature of this effect appears to be correlated with the effect of pH on the growth requirements of the pathogen.

Both stimulatory and inhibitory effects on growth by both pathogens were observed in tests employing basal medium supplemented with certain amino acids either singly or in combinations. A differential effect on the growth of X. phaseoli and of X. phaseoli var. sojensis was obtained. When the pathogens were grown in media at comparatively low pH levels, the differential effect was enhanced.

Both pathogens possess the capacity to utilize tryptophan in the production of an indole derivative. This property is greatly modified, however, depending on 1) the pH of the medium and 2) the presence or absence of other sources of nitrogen in medium containing tryptophan. Culture filtrates of both pathogens were shown to contain auxin when the organisms were grown in medium containing L (+) tryptophan as the sole source of nitrogen.

The two pathogens were differentiated by in vitro studies employing certain compounds as carbon sources in fermentation medium. Glucose-1-phosphate and fructose-1, 6-diphosphate proved to be suitable substrates for X. phaseoli, whereas X. phaseoli var. sojensis failed to utilize them. In fermentation medium containing sodium ammonium pectate, cultures of X. phaseoli var. sojensis gave a positive test for the presence of pentose, whereas only negative results were obtained for cultures of X. phaseoli. With the exception of a single isolate, all isolates of X. phaseoli var. sojensis grew in mannitol medium. Growth by X. phaseoli in mannitol medium was not observed.

122 pages. $1.53. Mic 56-661

RESPONSE OF LEGUMINOUS CROPS TO BORAX FERTILIZATION

(Publication No. 15,261)

Darrell Arden Russel, Ph.D.
University of Illinois, 1955

Field trials with borax fertilizer were established at 14 locations in Illinois and results from five representative locations were reported. The data for two years included hay yields, seed yields, and leaf-to-stem weight ratios.

Extensive laboratory work was done on samples from the field trials. Soil test values for water-soluble boron, chemical composition of plant samples (for B, Ca, Cu, Fe, K, Mg, Mn, N, Na, P, and Si), nutrient ratios, and yields of nutrients were determined.

To obtain information about methods of determining boron in plant material, a study was made of ashing techniques and chemical procedures.

The results and conclusions were as follows:

1. The application of borax fertilizer (0, 30, 60, and 90 pounds per acre) to leguminous crops resulted in an increase in the yield of forage hay for alfalfa growing on a soil testing 0.25 p.p.m. of water-soluble boron. An increase in seed production for alfalfa growing on a soil testing 0.26 p.p.m. of water-soluble boron was also obtained.
2. The effect of borax fertilizer on leaf-to-stem weight ratios was inconclusive, as both positive and negative linear trends were obtained.
3. Application of borax fertilizer to the soil resulted in increases in the concentration of boron in plant tissue but did not consistently affect the concentration of Ca, Cu, Fe, K, Mg, Mn, N, Na, P, or Si. The yield of nutrient was affected more by the total hay yield than by the rate of borax application.
4. An optimum range of ratios for Ca/B, Cu/B, Mg/B, and N/B was suggested by the data since alfalfa that responded to borax fertilization had higher ratios than non-responsive alfalfa. No optimum range of ratios was found for Fe/B, K/B, Mn/B, Na/B, P/B, or Si/B.

5. Untreated plots showed an increase in water-soluble boron at the close of the first cropping season. No adequate explanation for the increase could be given nor could the effect of this increase upon the yield of forage hay be assessed. Water-soluble boron in soils treated with borax fertilizer increases in proportion to the rate of application. The rate at which borax fertilizer penetrated into the soil was found to be dependent upon the permeability of the soil.

6. Oxidation of plant materials with nitric and perchloric acids led to consistently low values for the concentration of boron while oxidation with hydrogen peroxide led to erratic values, depending upon the chemical method used in determining the boron.

7. Ignition of plant samples in a muffle furnace at 600° C. for 2 hours gave satisfactory results for boron in plant samples. The addition of a buffer to prevent volatilization of boron during ignition was not necessary.

8. The chemical procedure used for measuring the concentration of boron in plants had little, if any, effect upon the boron value obtained, unless the analysis solution was obtained by a hydrogen-peroxide oxidation.

9. Correlations between chemical determinations and spectrographic determinations of Al, B, Ca, Cu, Fe, K, Mg, Mn, Na, P, Si, and Zn in plant samples were determined. The correlation coefficients were above 0.7218 for all elements except Al and Zn. The coefficient for Al was 0.1952; a negative correlation was found for Zn.

252 pages. $3.15. Mic 56-662

THE INFLUENCE OF VARIOUS LEVELS OF CALCIUM, POTASSIUM, AND MAGNESIUM IN THE SOIL ON THE ABSORPTION AND YIELD RESPONSE TO POTASSIUM AND MAGNESIUM BY SEVENTEEN VEGETABLE CROPS

(Publication No. 15,904)

Steve Lee Windham, Ph.D.
Michigan State University, 1953

Seventeen vegetable crops, onion, cabbage, cauliflower, pea, lima bean, snap bean, beet, spinach, celery, carrot, sweet corn, tomato, potato, muskmelon, cucumber, squash and lettuce were grown under all combinations of three pH levels (6.5, 6.0, and 5.5), three potassium levels (220, 120, and 12 pounds applied to the acre) and two magnesium levels (50 and 0 pounds applied to the acre). Marketable yield and total plant growth were recorded and samples were collected for chemical analyses as each crop reached maturity. The Beckman Model DU Flame Spectrophotometer was used for analysis of calcium potassium, magnesium, and sodium. Total removal of potassium and magnesium was calculated.

Potassium was the dominant ion and occurred in greater concentrations than magnesium in every crop. The potassium:magnesium ratios varied from approximately one in muskmelon vines to 14 in potato tubers. Variations in magnesium concentrations were greater than potassium among different botanical families but variations of potassium concentration were greater than magnesium within crops of the same botanical family. The maximum potassium concentration in spinach was approximately five times that of the minimum in onions. The maximum magnesium concentration in potato vines was approximately 10 times the minimum in onions and potato tubers.

In general the order in which potassium concentration in crops was altered by cation applications was potassium >calcium>magnesium, whereas, the order in which magnesium concentration was altered was magnesium>potassium>calcium. Large variations in magnesium concentrations, as influenced by treatment, were found in crops with relatively high percentages of magnesium. In the same crops potassium concentrations were also varied to a greater extent by applications of other cations.

In most crops wide variations in the percentage of either magnesium or potassium were not reflected in marked difference in marketable yields. However, relatively high potassium concentrations in spinach and beets, and relatively high magnesium concentrations in beets were associated with maximum yields. The potassium requirements of snap beans, potatoes, tomatoes, and muskmelon were greater at pH 6.5 than at pH 5.5 as indicated by significant increase in marketable yields when these crops were grown on plots that had received high potassium application. Marketable yields of celery, tomatoes, potatoes, muskmelons, snap beans, and squash from medium potassium plots were significantly greater than yields from low potassium plots.

Magnesium significantly increased beet yields, decreased carrot yields, and had little effect on yields of other crops.

Carrot removed approximately 10 times as much potassium as spinach and lettuce, and three times the average quantity removed by all crops. The quantity of potassium removed by any crop grown on high or medium plots was significantly greater than the amount removed from low potassium plots. At pH 6.5 the quantity of potassium removed by beet, spinach, celery, and carrot was significantly greater than at pH 5.5. Beets removed 11 times as much magnesium as spinach and four times the average quantity removed by all crops. Magnesium applications significantly increased the magnesium removed in lima bean, beet, spinach, celery, onion, cabbage, and carrot. High potassium significantly reduced the amount of magnesium removed by lima beans and potatoes and liming significantly influenced the quantity of magnesium removed by lima bean, beet, spinach, celery, carrot, and potato.

These results suggest that both differential cation absorption by crops and characteristics of individual ions influence composition and yield response to both potassium and magnesium. In this experiment most of the crops were quite tolerant to wide variations in either potassium or magnesium concentrations as indicated by the slight differences in marketable yields. However, significant decreases of magnesium uptake by application of other cations suggest that yields may be reduced by applying lime or potassium to extremely sandy soils or to soils with a high base exchange capacity where magnesium content is relatively low.

106 pages. $1.33. Mic 56-663

THE HISPANIC ACCULTURATION OF THE GILA RIVER PIMAS

(Publication No. 15,912)

Paul Howard Ezell, Ph.D.
University of Arizona, 1956

When the Gila Pimas came into contact with Hispanic culture at the close of the 17th century, they had a relatively stable culture and economy. Subsistence was based on irrigation agriculture, supplemented by hunting and gathering. Except in basketry and weaving, their technology was simple. There were no full-time specialists. The social organization was based on the patrilineal extended family, complicated by forms of relationships which cut across family and village lines. Leadership was just beginning to extend beyond the village. The interests of the society were focused on curing, social relationships, and agriculture. Hospitality and peace were the two discernible values of the society.

During the one hundred sixty years of Hispanic contact, the Gila Pimas were in an advantageous position in their relationships with the Whites. No immigrant establishment was ever located within their territory, and they were valued as one of the defenses of Sonora against encroachment from the north. Contacts between agents of the two cultures occurred intermittently and in an atmosphere of equality, rather than continuously and under conditions of domination. The Gila Pimas were thus never forced to live under two sets of values, and were able to choose what of Hispanic culture they wished to accept. They chose elements which they deemed desirable for their material benefit, rejecting others offered them. Consequently, Gila Pima culture was enriched by the Hispanic contacts, and readiness to adopt new cultural traits was stimulated. The continuity of the culture was uninterrupted, however, and no major reorientation took place, although the development of an orientation toward war was in process.

Culture contact under those conditions has been defined as the situation of non-directed acculturation. The response of the Gila Pimas to that kind of acculturation situation was to develop a pattern of adjustment designated as selective acceptance with no major reorientation, and it is suggested that such a pattern of adjustment is only possible in a situation of non-directed acculturation.

460 pages. $5.75. Mic 56-664

THE CULTURAL AND SOCIAL IMPACT OF AN AMERICAN AIRBASE UPON AN URBAN FRENCH COMMUNITY

(Publication No. 15,738)

Orvoell Roger Gallagher, Ph.D.
Columbia University, 1955

This dissertation is based on research in a French community, near which an American airbase was established in 1951. At the time of the fieldwork in 1953-54, there were approximately 6,000 American airmen stationed at this airbase. The problems arising from the research are: (1) why some groups in the French community are more sensitive than others to the presence of the Americans; (2) what in French culture and society seems to inhibit or encourage intercourse with and receptivity towards those of another culture; and (3) what may be suggested as a result of the Franco-American contact about types of contact situations generally, the effect of such contact factors as the time element involved or of the relative complexity of each of the cultures involved which may facilitate or restrict intercourse or receptivity to trait borrowing.

Analysis of the socio-economic organization of the French community reveals the predominance of a near pre-capitalistic economy in which the family-type enterprise is typical. These enterprises, family-owned and managed, and by American standards, inefficient, are resistant to change and to technical improvement, for the outside capital required for modernization and standardization would threaten family control. Though the owners of family businesses still control the community, politically and economically, they have been threatened for the past several decades from two sides, first, by the efficiency-oriented branches of Paris-owned corporations, and secondly, by a still divided, but growing proletariat.

The American impact is a stimulation of already existent industrialization trends. Though profitable to the owners of cafe-bars, restaurants, and hotels, the American presence adversely affects many of the family-owned businesses. The growth of the community has been accelerated, and the competition for an already scarce labor supply increased. The influx of working class families into the community increases the numbers of those who traditionally vote against the political parties supported by the middle and upper classes. The workers, benefiting from the added work opportunities at the airbase, use such employment as a lever in bargaining against local employers.

While the French class system, traditional French beliefs about the low status of soldiers, and differing daily schedules are barriers to intercourse between Americans and middle and upper class Frenchmen, French familial exclusiveness, suspicion of strangers, restrictions on easy intimacy, and the disapproval of romantic-love patterns in marriage — all patterns reflecting the close link between family and property — are perhaps more important in restricting the relations Frenchmen may have with outsiders

such as the Americans. The French upper and middle classes are, therefore, for familial reasons and because of their threatened economic-political positions, unable and unwilling to accept Americans and Americanisms; the proletariat are willing but not able.

The contact is yet in a pre-acculturational stage. The French have not reacted to the American contact homogeneously nor by automatic borrowing of American traits. Rather, at this stage of the contact, affected groups within the French community are striving to maintain sometimes already threatened positions — or by attempting to improve present positions. Based on the present research, it is concluded that trait borrowing is neither automatic nor even a necessary consequence of culture contact. At least in the early stages of contact, and perhaps especially in situations involving cultures of near equal complexity meeting on terms of equality, there may be a relatively long period of mutual adjustment before the question of trait borrowing arises. 221 pages. $2.76. Mic 56-665

BACTERIOLOGY

THE NATURE OF LYSOGENICITY IN XANTHOMONAS PRUNI

(Publication No. 15,906)

Lewis B. Bernstein, Ph.D.
Kansas State College, 1956

Lysogenization as a tool of the virologist for approaching the problem of viral synthesis and multiplication has gained prominence in the last five years. The experiments described in this dissertation were initiated when a variant Xanthomonas pruni host resistant to Xp4 exhibited a spontaneous lysis. The phages liberated from these cultures appeared to be different from Xp4, and the phenomenon was suggestive of a lysogenizing process.

Investigations were carried out to determine whether or not lysogenicity per se exists in X. pruni, or if the production of the "new" phage (Xp8) is due to some other process. Experiments were performed to establish that Xp8 was different from all other X. pruni phage strains, and more specifically, different from Xp4 which appeared to be involved in its origin, and to determine the origin and mechanism(s) of Xp8 formation.

Lysogenic cultures of X. pruni could be isolated only after the normal susceptible host H-1 has been exposed to Xp4. The possibility of H15L (the lysogenic strain) being present in populations of H-1 in small numbers, and that Xp4 merely selected for them was eliminated. Xp4 stocks were tested to determine if Xp8 was present in small numbers as a contaminant. No evidence for Xp8 contamination was found.

Xp8 could represent a random spontaneous mutation of Xp4 occurring in Xp4-infected cells of H-1 after replication had occurred. Analysis of frequency distribution of Xp8 arising from Xp4-infected cells failed to follow a calculatable Poisson distribution, and was found to be non-random, but clonal. This presents the possibility that Xp8 represents a host-controlled modification of Xp4.

H15L and H/4 both demonstrated the characteristic immune reactions of lysogenic bacteria. Both strains were found to adsorb Xp4, but not support its multiplication or be killed by the phage. However, H/4 was lysed by Xp8. A test to determine if after adsorption of Xp4 by H/4 any Xp8 would be released was performed. Analysis of frequency distribution gave the same results as obtained from Xp4-infected H-1 cells as regards the production of Xp8. This indicates that the origin of H15L(Xp8) is from a reductive process or host-controlled modification of Xp4 by "special" (H-1)' cells present in a normal population of H-1 in two steps:

(1) $Xp4 + (H\text{-}1)' \longrightarrow H/4 \xrightarrow{+Xp4} (H/4)'$
(2) $(H/4)' + Xp4 \longrightarrow H15L \longrightarrow Xp8$

No physiological or morphological differences were found between H15L and H-1. H15L was more resistant to UV inactivation than H-1.

The phage liberated by H15L has stabile hereditary properties different from Xp4 and the other Xp-phages. It differed in UV sensitivity, thermal inactivation rate, host range, serology, plaque morphology, and burst time and burst size.

Induction of lysogeny in H-1 and H15L by chemical and plysical agents was unsuccessful. The possibility that X. pruni harbour Xp8 prophage is discussed.

Exposure of Xp4 and Xp4-infected H-1 cells to 3,6-diaminoacridine resulted in the mutation of Xp4 to Xp8 in relatively high frequencies. The mutagenic effect of the acridine on the Xp4-infected H-1 cells took place primarily after the eclipse period. The effect on Xp4 itself is direct evidence that Xp8 is derived from Xp4. The basic difference between Xp4 and Xp8 may be due to the lack of synthetic ability of the (H-1)' cells to form a small segment of an Xp4 chromosome which makes the resultant phage characteristically Xp8. All evidence seems to point to the origin of Xp8 as a result of host-controlled modification of Xp4. 55 pages. $1.00. Mic 56-666

THE CYTOPATHOGENIC EFFECT OF HOG CHOLERA VIRUS AND PSEUDORABIES VIRUS IN TISSUE CULTURE

(Publication No. 15,821)

John Alfred Christensen, Ph.D.
The Ohio State University, 1955

Hog cholera is one of the most important diseases of swine. Since the recognition of its virus etiology in 1903, considerable progress has been made toward controlling the disease by vaccination. However, as yet no practicable method of laboratory diagnosis is available.

Certain investigators have shown that the primary lesions in hog cholera are in the blood vessels of various organs, and that the cell types primarily affected in these lesions belong to the reticulo-endothelial system. Published reports on the cultivation of hog cholera virus in vitro all involve the serial transfer of the virus in cultures of suspended tissues such as spleen, bone marrow, and lymph nodes. No indication of a cytopathogenic effect on any of the cell types present in these cultures has been reported.

The primary purpose of the investigation was to determine whether the tissue culture method could be used in the diagnosis of hog cholera. The viruses employed were virulent hog cholera virus, lapinized hog cholera virus, and pseudorabies virus, the last-named being used in some experiments as a positive control. The roller-tube plasma clot method was used for culturing swine subcutaneous tissue, as well as testis and kidney from rabbits and swine. Swine bone marrow and embryonic swine spleen were cultured directly on glass cover slips within culture tubes, which were incubated in stationary racks. Tissues were minced with scissors or chopped into small fragments with two Bard-Parker blades. One or two drops of a thick tissue suspension in balanced salt solution were transferred to culture tubes with a capillary pipette. Two ml. of culture medium of the following composition was added to each tube: 50 per cent human ascitic fluid, 45 per cent balanced salt solution, 5 per cent chick embryo extract, and penicillin and streptomycin in concentrations of 100 units and 0.1 mg. per ml. respectively. Observations on growth or cytopathogenic effects were made periodically by examining unstained cultures at 100 magnification or by examining cover-slip preparations stained with May-Grunwald Giemsa.

Four main cell types were encountered: (1) reticulum cells, from cultures of embryonic swine spleen, (2) tissue basophils, from swine bone marrow, (3) fibroblasts, from swine subcutaneous tissue and embryonic spleen, as well as from cultures of rabbit and swine testis, and (4) epithelial cells from cultures of rabbit and swine kidney. Descriptions of these cell types and the factors involved in their growth and maintenance are presented in the dissertation.

Cytopathogenic effects were observed in the above cell types after inoculation with pseudorabies virus or hog cholera virus. Pseudorabies virus produced a rounded, pyknotic nucleus and disintegrated cytoplasm in fibroblasts or epithelial cells from rabbits or swine. In reticulum cells, pseudorabies virus produced a generalized necrosis, with ghost nuclei. In tissue basophils, hog cholera virus produced a generalized necrosis which was qualitatively indistinguishable from nonspecific degeneration; however, a larger number of necrotic cells were observed in inoculated cultures. Hog cholera virus produced a cytoplasmic granulation in reticulum cells which increased in severity and in many cases was accompanied by pyknosis twenty-nine days after inoculation. Uninoculated controls contained a small number of cells with pyknotic nuclei, but none with granulation. On the first tissue culture passage, the cytopathogenic effect of hog cholera virus on reticulum cells was inhibited by anti-hog cholera serum. Hog cholera virus had no effect on fibroblasts or epithelial cells from swine. Lapinized hog cholera virus did not affect fibroblasts or epithelial cells from rabbit tissues.

The findings suggest that hog cholera virus has a predilection for the cells of the reticulo-endothelial system. However, the slow progression of infection in reticulum cells, along with the apparently low concentration of virus in culture fluids, indicates a poorly adapted virus-cell system. The virus would have to become adapted, through a number of serial passages, before such a method might be considered for use in diagnosis of hog cholera.

81 pages. $1.01. Mic 56-667

OPSONIC FACTORS IN ERYTHROPHAGOCYTOSIS BY MACROPHAGES IN TISSUE CULTURE

(Publication No. 15,858)

Dabney Shelton Mabry, Ph.D.
The Ohio State University, 1955

In order to examine the premise that erythrocytes from hemolytic disease states might be more susceptible to phagocytosis by macrophages, an in vitro test roughly simulating in vivo conditions was standardized. Essentially the test consisted in determining the degree of phagocytosis, by three- to five-day-old splenic macrophages in tissue culture, of a variety of normal and modified erythrocytes in the presence of human and rabbit sera. Although a certain small amount of phagocytosis occurred with normal red cells tested in stored serum, appreciably higher values were obtained for cells modified in vitro by various types of enzymes or viruses under the same conditions. The results of the work presented in the dissertation, originally intended to interpret these early empirical results, not only accomplish this end but also contribute information relative to the problem of the nature of normal serum opsonin and the role of complement in phagocytosis in immune serum.

Maximum phagocytosis as defined here is the ingestion by macrophages of all of the erythrocytes of which they are capable in 20 to 35 minutes, depending on the particular cell type and under the proper conditions. Maximum phagocytosis is considered to occur when approximately 70 to 95 per cent of the macrophages contain one to twenty or more red cells. Phagocytic indices for all types of modified erythrocytes increased markedly up to a given time, reached maxima, and then decreased markedly. A culture of macrophages which had accomplished maximum phagocytosis of susceptible cells would not ingest similar cells for a period of about six hours. Addition of fresh erythrocytes and serum at this point resulted in maximum phagocytosis occurring as before, followed by a similar period of inactivity. This temporal cycle was observed repeatedly over a continuous period of 42 hours. This may be related to some unknown relationship between the energies involved in ingestion and digestion.

Conditions for obtaining minimal and maximal phagocytosis such as normal serum opsonin, antibody, complement, incubation time, age of macrophages, concentration of susceptible red cells, and method of denoting phagocytic index were examined. Minimal phagocytosis occurred in any serum, but no phagocytosis was present in the absence of serum. Human, rabbit, and chicken red cells modified in vitro by enzymes or viruses as well as heterologous normal cells were susceptible to phagocytosis in normal human or rabbit serum. Maximum phagocytosis of any of these cell types in normal serum was shown to occur in 20 to 35 minutes depending on the particular cells. Factors required

for maximum phagocytosis were primarily thermostable, specific components of normal serum and complement. Certain quantitative aspects of the complement requirement were also indicated. In addition, it was shown that components C'3 and C'4 were necessary for opsonization, and C'3 appeared to activate opsonization in much the same manner that it activates hemolysis.

Erythrophagocytosis was increased by specific immune serum, but maximum phagocytosis in such instances also required complement. Complement had no effect on the specificity or absolute degree of the opsonic reaction in immune serum, but only on the rate of phagocytosis. Red cells more susceptible to phagocytosis were detected in experimental Newcastle disease in chickens. This indicated the probable occurrence of erythrocyte modifications in vivo similar to the above in vitro modifications by virus.

Possible mechanisms for phagocytosis as a removal process for red cells in normal and hemolytic disease states were postulated. 86 pages. $1.08. Mic 56-668

AN INVESTIGATION OF THE EFFICIENCY OF THE QUATERNARY AMMONIUM GERMICIDES IN THE PRESENCE OF HARD WATER

(Publication No. 15,481)

Frank Robert Peabody, Ph.D.
Michigan State University, 1952

The survivor-curve test of Weber and Black was used for the first phase of the studies. The interfering action of the college tap water with the germicidal action of a quaternary ammonium compound (QAC) was shown to be a retarding of the action rather than a direct neutralization of the germicide. When the water was softened by different methods, no difference in the interfering action was noted except when using Versene. The addition of this complexing agent resulted in a marked reduction in the interfering action of the hard water. Subsequent testing with Versene in distilled water proved that the action is more than the softening action on the water. A definite increase of germicidal action resulted from the addition of Versene to the QAC in distilled water whether the Versene was added to the organisms or to the germicide.

When repeated dosages of organisms were added to the same disinfectant solution, a reserve of germicidal action was demonstrated even in the presence of tap water. To illustrate this more readily, the exhaustion test was designed in which successive increments of organisms were added to the same disinfectant solution and samples taken ten minutes after the addition of each increment. In this way, the number of increments that could be added before the germicidal action was "exhausted" could be determined.

By utilizing the strong complexing action of the Versene, the germicidal action of the QAC which had been inactivated by the hard water could be released again to exert a germicidal action comparable to that of QAC in distilled water. This release of germicidal action was also demonstrated without the use of Versene by allowing an extended period for the germicide to be released from its combination with the interfering factor in the hard water.

87 pages. $1.09. Mic 56-669

BIOCHEMICAL CHARACTERISTICS OF COAGULASE-NEGATIVE VARIANTS OBTAINED FROM A COAGULASE-POSITIVE CULTURE OF MICROCOCCUS PYOGENES VAR. AUREUS

(Publication No. 15,394)

Jack Norman Baldwin, Ph.D.
Purdue University, 1950

Major Professor: Dr. H. Koffler

A known pathogenic culture of Micrococcus pyogenes var. aureus was exposed to ultraviolet radiations in an attempt to produce variants lacking the in vitro characteristics of the pathogenic micrococci.

The over-all procedure was to irradiate a washed suspension of the parent culture, which was orange, coagulase-positive, alpha-hemolytic, produced acid from mannitol, and grew well in a medium devoid of biotin. The irradiation procedure was carefully standardized so as to produce 99.99 per cent killing. The surviving cells were screened for "zero-point" and "end-point" variants using lack of chromogenesis as the criterion of a variant. "End-point" rates were determined also using lack of coagulase production and lack of capacity to grow in the absence of biotin as evidence of a variant. The irradiation was found to increase the occurrence of non-chromogenic variants, approximately 6 times. The rate of appearance of the variants screened directly for coagulase production and the inability to grow in the absence of biotin was increased 5 and 9 times, respectively. There was a 2.5 increase in the number of "end-point" variants over the number of "zero-point" mutants.

One hundred and fourteen non-chromogenic variants that showed no color reversion after 16 daily transfers on yeast-water, veal-infusion were tested for fermentation reactions and other physiological tests commonly used to identify pathogenic micrococci. A total of 114 variants were tested, of which 32 were found to be coagulase-negative and 82 coagulase-positive. One hundred and fifty orange strains isolated at random from plates streaked in an irradiated suspension of the culture were tested also. All 32 of the non-chromogenic coagulase-negative variants were sharply differentiated from the coagulase-positive strains, both white and orange, by their inability to produce alpha-hemolysin and acid from mannitol anaerobically. When tested

for their ability to grow in a medium devoid of biotin a similar correlation was found to exist; coagulase-negative variants required biotin for good growth in a synthetic medium, while coagulase-positive strains grew equally well in the presence of absence of biotin in the medium.

Forty-three additional variants tested were also found to lack this same set of pathogenic characteristics that Evans (1948) and Evans and Niven (1950) found to be lacking in micrococci isolated from natural sources.

Ultraviolet survival curves of 4 randomly selected, coagulase-negative variants showed that these strains were not "selected out" due to an increased resistance to ultraviolet radiations. 120 pages. $1.50. Mic 56-670

THE BIOLOGY OF THE CORN LEAF APHID, RHOPALOSIPHUM MAIDIS (FITCH), AS AFFECTED BY RESISTANT AND SUSCEPTIBLE VARIETIES, HYBRIDS AND SELECTIONS OF SORGHUMS, SORGHUM VULGARE PERS.

(Publication No. 15,907)

Jean Jacques Cartier, Ph.D.
Kansas State College, 1956

The discovery of two biological races (KS 1 and KS 2) in the corn leaf aphid, Rhopalosiphum maidis (Fitch) occurred during the present studies on the resistance of sorghums of this insect. The range of distribution of these races in nature is not yet known. Their biology and their behavior have been analyzed quantitatively during preference and antibiosis tests in the presence of, or on susceptible, intermediate, and resistant sorghums. Biotype KS 2 was able to reproduce itself on a resistant host while the other only occasionally, barely subsisted. Biotype KS 2 always produced heavier adults than biotype KS 1. The resistance of sorghums was analyzed by measuring separately the mechanisms of preference and antibiosis. Tolerance may be an important factor but so far has been difficult to study.

In 50 varieties, hybrids and selections of sorghums, involving 5,000 plants, preference was a part of the inherited qualities which remained constant under varying intensities of infestation. Non-preference, as observed in the F_1 hybrid of a cross between White Martin (preferred) and Piper 428-1 (non-preferred) appeared to be transmitted as a dominant character. The F_2 generation was intermediate between the parents. There was in White Martin (preferred) a factor which, within a test period of one hour stimulated the females to give birth to nymphs. Conversely, there was in Piper 428-1 (non-preferred) a factor which, within a test period of one hour inhibited almost totally the stimulus to give birth to nymphs. The expression of antibiosis in reducing the fecundity of biotype KS 1 behaved as a completely dominant factor in Piper 428-1, partially dominant in the F_1, and recessive in White Martin; in reducing the weight of the adults, the character behaved as dominant in Piper 428-1, partially dominant in the F_1, and recessive in White Martin. The expression of antibiosis in reducing the fedundity of biotype KS 2 appeared to be partially dominant in Piper 428-1 and recessive in the F_1 and White Martin; while in reducing the weight of the adults, the expression appeared to be partially dominant in Piper 428-1 and the F_1 and recessive in White Martin. The antibiosis of Piper 428-1 affected biotype KS 1 by reducing the weight of the females as soon as they fed on that host and preventing the maturing of their progeny, if any. Biotype KS 2 was affected to a lesser degree. In the progeny of Piper 428-1, the near immunity against biotype KS 1 has been lost probably through segregation, and both biotypes were equally affected. The antibiosis of the original selection must have been the result of a very particular genic composition. As observed from the progenies of single viviparous females caged on F_2 plants, the resistant or the susceptible genotypes reduced or increased the fecundity of the females and the weight of the adults in the progenies as the original parents did.

Aphids reared separately on the heads of White Martin were heavier and their rate of reproduction was doubled and tripled compared to others reared on lower leaves of the same plants.

Antibiosis totally or partially inhibited the mechanisms of wing production in the progenies of apterous females.

Six mechanisms of either preference or antibiosis were found responsible for resistance. These mechanisms appeared to be either dominant or partially dominant in their expression because the biotypes showed differential reactions to the same host. The non-discrete segregation in the F_2 plants and the F_3 lines suggests a multiple factor hypothesis. 84 pages. $1.05. Mic 56-671

A STUDY OF THE FACTORS THAT AFFECT THE PHYTOTOXICITY OF MIST CONCENTRATE FORMULATIONS TO AMERICAN ELM (ULMUS AMERICANA L.) AND SOME OTHER WOODY ORNAMENTAL PLANTS

(Publication No. 15,006)

Dan Fredric Clower, Ph.D.
Cornell University, 1955

The phytotoxic properties of mist concentrate formulations and the factors affecting phytotoxicity were investigated by means of overdose applications.

Most insecticides and acaricides were less toxic to plants when applied in emulsion formulations than when oil solution formulations were applied. Carrier oils such as Shell Horticultural Base oil #7, an experimental carrier oil, L-1543 and kerosene were hazardous to use and gave severe injury under certain conditions. Another carrier oil, Sovaspray 100, was less toxic and in most cases DDT solution formulations utilizing it gave no more injury from it than did xylene-DDT emulsions.

Each ingredient included in a mist concentrate formulation affected the toxicity of the formulation to plants. Most of the common insecticides and acaricides are inherently phytotoxic and tend to increase the toxicity of the formulation.

The addition of a co-solvent, such as xylene, to the formulation frequently results in an increase in the plant toxic properties. Results of phytotoxicity investigations already published, (Matthysse and Clower, 1951), showed that xylene and xylene-type volatile aromatics were less injurious than were less volatile petroleum aromatics including the methylated naphthalenes. Experiments reported in this thesis

indicated toluene to be the least phytotoxic of a series of twelve benzene derivatives tested and acetone to be the least phytotoxic of the three ketones investigated. Chemically pure mono-methyl naphthalene was very phytotoxic to elms.

The addition of an emulsifier may also increase the toxicity of the formulation to plants.

Very little difference in phytotoxicity was noted when twelve proprietary emulsifiers were tested in DDT emulsions on American elm. Increasing the concentration of Triton X-100 in 5% DDT emulsions increased the phytotoxicity to both American elm and sugar maple.

Several mist blower formulations including both emulsions and solutions were tested on dormant elm trees. Inclusion of white oil in the emulsions increased the degree of injury. Four insecticides formulated as water emulsions, kerosene solutions and Sovaspray 100 solutions were applied to dormant elms in 1954. Malathion was the only insecticide that gave severe injury when applied as an emulsion formulation. Oil solutions of the insecticides formulated with kerosene and Sovaspray 100 all gave severe injury.

American elms vary in susceptibility to injury by mist concentrate formulations according to their stage of development. They are relatively resistant to injury before the leaf buds break in the spring but become more susceptible after the buds open and the leaves start developing. Later in the mid-summer, the leaves harden off and become relatively resistant to injury by spray formulations again. Applications made to the bottom surface of the leaves gave more injury than to those made to the top surface.

Light intensity at the time of treatment apparently affects the toxicity of emulsion and solution formulations. Applications made just before dark and at night gave less injury than did those made during the day under conditions of bright sunlight. A very limited experiment indicated that the moisture content of the soil had little effect on the susceptibility of American elm seedlings to injury by DDT emulsions. Observations in small scale experiments and also in large plots where the treatments were applied with mist blowers indicate that individual American elms vary considerably in their susceptibility to injury by deposit formulations. It was also found that different species of plants vary in their susceptibility to injury by different toxicants. 119 pages. $1.49. Mic 56-672

CHEMICAL CHANGES OCCURRING DURING THE SUBMERGED GROWTH OF STREPTOMYCES GRISEUS AND FACTORS INFLUENCING STREPTOMYCIN YIELDS (PARTS I, II, AND III)

(Publication No. 15,401)

Mohamed Fahmy, Ph.D.
Purdue University, 1950

Major Professor: P. A. Tetrault

The chemical changes induced by S. griseus during submerged fermentation follow a distinct pattern. On a glucose, peptone, beef extract, and sodium chloride medium the metabolic changes can be divided into 3 phases. During the first phase, the mycelium is formed rapidly. It is produced largely during this phase from the organic constituents of peptone and beef extract. The carbon of the organic nitrogen compounds is used faster than the nitrogen and as a result ammonia increases and the pH of the medium rises. Little glucose is used in this phase and streptomycin is formed in very small amounts or not at all. When the available carbon in the nitrogenous compounds is exhausted, the second phase begins. Glucose is rapidly utilized and the mycelium reaches its maximum growth. The ammonia which had accumulated during the first phase is completely utilized, and the pH decreases. Streptomycin increases steadily reaching its maximum somewhat after the maximum growth. When the nutrients become exhausted the third phase begins. Autolysis of the mycelium takes place with consequent rise in the ammonia nitrogen and the pH. Soluble nitrogen is released in the medium and the streptomycin concentration decreases.

The chemical changes can be modified if changes are made in the medium. When distilled water replaces tap water, the different phases are reached later. Glucose is not utilized rapidly, the ammonia which is liberated during phase 1 is not completely utilized, and the maximum mycelial growth is reached towards the end of fermentation. Medium high in beef extract supports good growth but gives low streptomycin yields. Ammonia is liberated in large quantities during the third phase. Addition of phosphate decreases the yields of streptomycin but does not appreciably change the metabolic pattern. Presence of magnesium stimulates the growth which reaches its maximum earlier than in a medium without magnesium.

The chemical changes occurring during fermentations by high and low yielding strains of S. griseus show that some differences exist between the two types. The low yielding culture of S. griseus strain V-6 utilizes the constituents of the medium at a slower rate than the high yielding strain E-15-1. Waksman strain #4 differs in its metabolic pattern from strain E-15-1. This shows that different strains respond to the medium in a different way.

Mineral elements play a significant role in the production of streptomycin. Iron and magnesium stimulate growth and streptomycin yields. Calcium increases the yields of streptomycin when added in concentrations which do not cause the formation of precipitates. Phosphorus itself is essential for growth but its presence in the medium at high levels decreases the yield. This effect is more marked in the presence of iron.

Waksman's medium to which no beef extract has been added supports little growth and low streptomycin yields. The complex organic portion of beef extract is not absolutely essential for the formation of streptomycin. The substitution for beef extract of its ash or inorganic phosphate supports the growth and the formation of streptomycin. Beef extract or its ash decrease streptomycin yields when used in high concentration. The effect of beef extract may be due to its phosphorus content.

142 pages. $1.78. Mic 56-673

STUDIES ON DOSAGE OF THE G_1 GENE AND ENZYMATIC ACTIVITY IN SACCHAROMYCES

(Publication No. 15,712)

Nels Marion Nelson, Ph.D.
University of Washington, 1955

Studies were made on methods of estimating the activities of enzyme systems believed to be required for galactose utilization in Saccharomyces — galactokinase, phosphogalactowaldenase, and phosphoglucomutase. Galactokinase was measured manometrically in a bicarbonate buffer (pH 7.8) and was found to require magnesium and a reducing agent, and to be active in the presence of sodium azide, an ATP-ase inhibitor. No satisfactory method for estimating phosphogalactowaldenase was found, but the presence of phosphogalactowaldenase was indicated by the fermentation of galactose-1-phosphate by aqueous suspensions of dired cells at pH 6.0. Phosphoglucomutase was measured at pH 7.5 by estimating the rate of disappearance of acid-labile phosphorus. Phosphoglucomutase activity was stimulated by magnesium and by a metal-binding agent, such as ethylene-diaminetetraacetic acid.

The effect of dosage of the G_1 gene on activities of the galactose-utilizing enzymes was investigated in ten clones each of tetraploid yeast with G_1 doses of 1, 2, 3 and 4. The G_1 gene was found to control galactokinase activity by increasing it with each G_1 dose. The average galactokinase activities (micromoles of galactose phosphorylated per mg protein per hour) for doses 1, 2, 3 and 4 were 6.2, 8.8, 11.4, and 13.4, respectively. The average hexokinase activities estimated under the same conditions, and given in the same order, were 20.0, 25.3, 23.8, and 21.7.

Phosphogalactowaldenase activity was one tenth that of galactokinase, so phosphogalactowaldenase activity was estimated relative to galactokinase activity assayed under the same conditions with aqueous suspensions of dried cells. The galactokinase activity of tetraploids with one G_1 dose was 79 per cent the phosphogalactowaldenase activity, while the galactokinase activity of tetraploids with four G_1 doses was 99 per cent the phosphogalactowaldenase activity.

There was no dosage effect of the G_1 gene on phosphoglucomutase activity. The activity of clones with doses of 1 and 4 were 18.5 and 16.5, respectively. Phosphoglucomutase activity was approximately four times greater in galactose-grown cells than in glucose-grown cells.

The dosage effect of the G_1 gene on maltase activity was also investigated to determine if the G_1 gene could control adaptive enzymes in general. No dosage effect was found. 92 pages. $1.15. Mic 56-674

ROOT-KNOT NEMATODE DEVELOPMENT AND ROOT TISSUE RESPONSES OF THE ROSE

(Publication No. 13,818)

Harold William Reynolds, Ph.D.
Purdue University, 1950

Major Professor: Dr. Charles L. Porter

A study is presented dealing with the parasitism of the root-knot nematode, Meloidogyne incognito Goeldi, on the roots of Rosa multiflora Thunb. Particular attention is given to host tissue responses and development of the parasite from the time it entered the root until fully developed. An identical and simultaneous experiment was conducted on an herbaceous plant, the tomato, Lycopersicum esculentum Mill., primarily as a comparative study. The length of the life cycle was determined for the parasite in each host, for the environmental conditions under which these studies were conducted.

Experimental data were secured by inoculating simultaneously a number of rose and tomato seedlings with a water suspension of viable larvae. Twenty-five to thirty roots were excised for study at four-day intervals until egg masses appeared on the surface of the roots for each host. One third of the excised roots were used as nematode stained and cleared root specimens; one third for demonstration of host cell and tissue responses; and the balance used for studying growth and development of the parasite. These three lots of excised roots were prepared for observations, photomicrographs, and camera lucida drawings in accordance with the standard laboratory techniques accepted for studies of this nature.

These studies show that the parasite entered the tomato root and established a nutritive relationship more quickly than in the rose. However, once the parasite became established, host tissue responses and development of the parasite progressed at about the same rate in each host.

The length of the life cycle of the parasite was 30 days in the rose and 22 days with the tomato. This is based on the time which elapsed between inoculation and the presence of larvae in egg masses resulting from the inoculations. Lateral roots were formed frequently from near the point of infestation on the rose. However, lateral root formation did not occur as often in the tomato. Gall formation was evident in the tomato soon after inoculation and this condition became more pronounced as the parasite developed. With the rose, gall formation did not occur at any stage of development of the parasite; however, egg masses were produced in abundance on the surface of the roots.

Egg mass production on roots of plants without gall formation should be of interest to the growers and plant inspectors. It is possible to overlook egg masses, in a casual macroscopic examination, and thus to mistakenly judge a plant free of the root-knot nematode.

The staining and sectioning technique used in this study demonstrated the presence of the parasites and the response of the host tissues and cells to good advantage. It is believed that this same technique may be used as an aid in determining the nature of resistance of certain plants to the root-knot nematode. 64 pages. $1.00. Mic 56-675

HOSTS OF SYNCHYTRIUM BROWNII AND THEIR REACTIONS TO INFECTIONS

(Publication No. 14,428)

James Thomas Sinski, Ph.D.
Purdue University, 1955

Major Professor: John S. Karlung

1. The host range of Synchytrium brownii which occurred on Oenothera biennis in the Ross Biological Reserve, Purdue University, was tested on 30 taxa, races or varieties, of 17 species in the genus Oenothera, and 10 species in the genera Circaea, Gaura, Godetia and Jussiaea. Under the conditions of these greenhouse tests, it infected 25 races of 8 groups and 5 species in the genus Oenothera, as well as, Clarkia elegans and Gaura coccinea.

2. A careful study of herbarium specimen labeled as S. fulgens on various hosts in several herbaria has shown that they are really S. brownii. Accordingly, in addition to the above hosts S. brownii occurs on Boisduvalia glabella, Oenothera bistorta, O. laciniata, O. rhombipetala and O. biennis.

3. The raction of these onagraceous hosts to infection by incipient prosori or resting spores manifests itself primarily by a marked enlargement of the infected cell. This is usually accompanied by division and subsequent enlargement of the surrounding epidermal, palisade and collenchyma cells causing thus the development of composite galls.

4. Based upon observations of single and scattered galls, S. brownii is compositely dihomeogallic in relation to its hosts because it induces both sporangial and resting spore galls which are composite or multicellular and thus similar in structure.

5. The mean height and width of the galls are as follows:

sporangial galls on the intervein, 140.67 x 128.31u;
sporangial galls on the vein, 86.70 x 132.81u;
resting spore galls on the intervein, 61.09 x 52.48u;
resting spore galls on the vein, 53.65 x 66.51u.

6. The sporangial and resting spore galls on the intervein region are imbedded largely in the host tissue, whereas the galls on the vein project largely above the epidermis. In this respect the galls produced as a result of infection by S. brownii and S. fulgens are the same. Also the sporangia produced are usually scattered on the surface of the leaf following dehiscence of the infected cell. Thus, the form of the gall produced cannot be used as a taxonomic criterion in reference to these two species.

7. The size, structure, and complexity of the galls produced vary on different hosts. On the Paducah (Ky.) race of the O. "biennis 1" group, they are predominantly simple and smaller while those on Gaura coccinea and the majority of other hosts are usually large in size and composite in structure.

8. On the intervein the mean size for the sorus is 84.57 x 96.69u and the sporangium is 17.31 x 20.00u. The mean number of sporangia per sorus is 23.44. On the vein the mean size of the sorus is 65.87 x 78.62u and the sporangium is 16.04 x 18.59u. The mean size of the resting spores are 41.33 x 46.43u on the intervein and 35.70 x 44.20u on the vein. The resting spores on the Paducah (Ky.) race are smaller than the mean, while those on Gaura coccinea are larger on the intervein but of mean size on the vein.

9. The standard deviation of the mean for the sizes of sori, sporangia and resting spores on the intervein and vein are less than the sizes of the sporangial and resting spore galls.

10. Other host reactions include:

a. the disorganization of the host nucleus at approximately the 5th or 6th day following infection by an incipient resting spore and on the 8th day following infection by an incipient prosorus.

b. large amounts of extraneous material develops in cells infected with incipient resting spores, while, in contrast, only a small amount develops in the cell infected with an incipient prosorus.

c. the disappearance of chloroplasts in the sheath cells derived from the mesophyll, and the deposition of gummous material in the majority of sheath cells.

11. Abortions of S. brownii occur in the cells of the Iowa II race of the O. "strigosa" group, the Paducah (Ky.) race of the O. "biennis 1" group, and Clarkia elegans. Acute abortions which are characterized by the death of the fungus and host cell a few days after infection occur on the Paducah (Ky.) race. Chronic abortions which occur approximately a week after infection are accomplished by the death of the fungus, and its frequent expulsion from the host cell occurs in the Paducah (Ky.) race, the Iowa II race, and Clarkia elegans. 70 pages. $1.00. Mic 56-676

AN ANALYSIS OF INSTABILITY AT THE R LOCUS IN MAIZE

(Publication No. 14,972)

Joan Klinger Stadler, Ph.D.
University of Missouri, 1955

Supervisor: John R. Laughnan

(1) This paper presents a study of four unstable alleles at the R locus in maize: R^v-1: and R^v-2: Cornell, r^v: Cherry and r^v:Beltsville. These have variegation for plant color, but not for seed color. The purpose of this study was to determine the basic nature of the instability at R and to see whether the mechanism of instability was the same for each of the four R^v alleles.

(2) The mutable R alleles were compared in their action in the change from variegated to self-color. $R^{r'}$ (fully colored) mutants were obtained from each unstable allele and their phenotype was tested for differences against the phenotype of a closely related R. It was demonstrated that R^v-1: and R^v-2:Cornell differ slightly from each other in that $R^{r'}$ mutants from R^v-1: always return to the full parental level of plant color, while some of the $R^{r'}$ mutants from R^v-2: have only slightly less color than the full parental plant color. However, the action of R^v-1: and R^v-2: differs widely from that of r^v:Cherry and r^v:Beltsville. These latter alleles produce a large number of $r^{r'}$ mutants which are near green in effect, as well as mutants with dilute levels of plant color and mutants with full plant color. The linearity of the diluted levels of plant color has been established for r^v:Beltsville.

(3) Segregation ratios, linkage relations and the $R^{g'}$ mutants were studied, and each R^v allele was directly tested for the presence of Activator. It was shown that

the variegation of the R^v alleles is not dependent upon an Ac-like factor and that no other controlling factor occurs in the R^v stocks, unless it is closely linked to R.

(4) The compounds R^v-2:/ r^v-2:Cornell, r^v:Cherry and r^v:Beltsville were crossed on two inbred genetic r^g stocks and a series of r^g stocks extracted with exotic modifiers. It was shown that R^v-2:, r^v-2:Cornell and r^v: Beltsville give a similar response to modifiers causing changes in the "normal" variegation phenotype but that R^v-2: and r^v:Cherry do not respond positively to the same modifiers.

(5) The presence of several functionally independent determiners of plant color would most logically explain the complex action of the long series of R plant color alleles. Assuming this to be true, it is argued that the basic mechanism of instability for all four R^v alleles must be one of temporary inhibition and release.

(6) Although this basic nature of instability is probably the same for each variegated R, these unstable alleles all differ in some aspect of their behavior in the change from variegated to self-color or their response to modifiers affecting the timing of variegation. Therefore, there may be as many as four different types of inhibition, or modes of control, in the variegation expressed by the four alleles.

140 pages. $1.75. Mic 56-677

INTERSPECIFIC HYBRIDIZATION IN PHASEOLUS AND IN CUCURBITA:
I. GAMETIC DIVERSITY AS AN AID TO INTERSPECIFIC HYBRIDIZATION IN PHASEOLUS AND IN CUCURBITA.
II. RECOMBINATION IN SPECIES CROSSES IN PHASEOLUS AND IN CUCURBITA.

(Publication No. 15,609)

James Robert Wall, Ph.D.
Cornell University, 1955

The hypothesis under test in Part I is that highly heterozygous plants are more likely to yield viable embryos in interspecific crosses than are relatively homozygous plants. The general procedure was to select three horticultural varieties from a species and cross them in all possible combinations. The varietal F_1 hybrids were then compared with the pure varieties as parents in interspecific crosses with a related species of the same genus. Three varieties of Cucurbita pepo were crossed in all possible combinations, and three varieties of Phaseolus vulgaris were crossed in all possible combinations with but one exception. The varietal F_1's and their parents were then crossed with a variety of a related species, i.e., C. moschata and P. coccineus.

Some varietal F_1 crosses gave much more favorable results (in respect to the number of viable embryos) in interspecific crosses than did others. In general it may be said of these interspecific crosses that the most favorable three-way intra-interspecific cross (a varietal F_1 of one species x a "pure" variety of another species) gives only slightly more favorable results than does the most favorable two-way interspecific cross. By far the largest number of viable embryos were obtained in Cucurbita when a four-way intra-interspecific cross (a varietal F_1 of one species x a varietal F_1 of another species) was used.

The position of the cotyledons on the central axis of Phaseolus seedlings was determined to be conditioned by multiple factors. The frequency distribution for cotyledon position in the F_2 of P. vulgaris x P. coccineus was significantly skewed in the direction of the P. vulgaris parent. There were marked shifts in cotyledon position in the F_3 and again in the F_4 toward that of the P. vulgaris parent. This was explained on the basis of progressive P. coccineus gene elimination through gametic and zygotic elimination. There was a significant negative correlation between seed yield and three morphological characters in the F_2 and one of three morphological characters in the F_3. These findings were explained on the basis that increased fertility is achieved at the expense of P. coccineus gene elimination from the gene complex. The evidence presented indicates that it would be very difficult to obtain desirable horticultural recombinations between P. vulgaris and P. coccineus characters.

Relatively free recombination was obtained in the F_2 of Cucurbita pepo x C. moschata. The implications of this finding to a practical breeding program are enumerated. Partial dominance of C. pepo characteristics over those of C. moschata was noted. Pollen abortion in the F_2 of C. pepo x C. moschata was not correlated with morphological characters. This is taken to mean that the more parental-like F_2 plants are no more fertile than are the more extreme recombination phenotypes.

104 pages. $1.30. Mic 56-678

THE EFFECTS OF A SERIES OF CYCLES OF ALTERNATING LOW AND HIGH SOIL WATER CONTENTS ON THE RATE OF APPARENT PHOTOSYNTHESIS IN SUGAR CANE

(Publication No. 15,806)

Floyd Milton Ashton, Ph.D.
The Ohio State University, 1955

An investigation of the effects of a series of cycles of alternating low and high soil water contents on the rate of apparent photosynthesis has been conducted with sugar cane (Saccharum officinarum L., Var. 37-1933) plants. Each of two similar potted plants approximately one year of age was placed in a photosynthetic chamber. One of the two plants was allowed to go through a series of five cycles of alternating low and high soil water contents; the other plant was maintained at a high soil water content and was used as a control plant. The high soil water content was maintained by thoroughly watering the soil daily, and the low soil water content was approximately the permanent wilting percentage. The rate of the apparent photosynthesis of each plant was determined once every half-hour by measuring the amount of carbon dioxide removed from the air after a 13-minute photosynthetic period. The carbon dioxide concentrations were measured by a recording infrared spectrophotometer. The measurement of the soil moisture was made by using a radiation technique of measuring soil density. The basic principle involved is that the fraction of radiation absorbed in passing through a layer of matter is proportional to the density. Changes in the density of Manoa soil under the conditions of this experiment resulted almost exclusively from changes in the moisture content.

In general, a relatively high rate of photosynthesis was maintained by the sugar cane plant until the soil moisture approached the permanent wilting percentage, and recovery of the original rate of photosynthesis following irrigation required several days. This was true in all five alternating cycles of low and high soil water contents.

There was a progressive increase in the daily cumulative rate of photosynthesis, as the cycles of alternating low and high soil water contents progressed from the first to the fifth cycle, on the day of irrigation, on the first day after irrigation, and on the second day after irrigation. The increase became progressively less marked on the last two of these days and was not clearly apparent on the third day after irrigation. There was also a progressive decrease in the interval of time before the sugar cane plant showed the first increase in the rate of photosynthesis following irrigation as the cycles of alternating low and high soil water contents progressed from the first to the fifth cycle.

An overnight recovery in the rate of photosynthesis occurred even when the soil water content approached the permanent wilting percentage.

An increase in the rate of photosynthesis of the plant under moisture stress occurred when there was a brief period of reduced light intensity but did not occur when the water supply was adequate. This was evident when a brief cloudy period occurred or when shadows were cast on the lower leaves by the upper leaves, a condition which occurred at midday when the sun reached its daily maximum height.

70 pages. $1.00. Mic 56-679

THE EFFECT OF SEED TREATMENT ON CONTROL OF DAMPING-OFF OF ORNAMENTALS; AND A STUDY OF A NEW FUNGAL PATHOGEN CAUSING DAMPING-OFF

(Publication No. 15,754)

Floyd Myron Clum, Ph.D.
Michigan State University, 1954

A study was conducted in which seeds of fourteen ornamentals were treated with certain of ten fungicides in various combinations in a series of field and greenhouse trials. In one or more trials significantly better seedling emergence occurred when seed protectants were used on seeds of Aster, Bachelor Button, Calendula, Cosmos, Four O'Clock, Morning Glory, Nasturtium, Phlox, Stock, Sweet Pea, and Zinnia. Marigold was the only ornamental on which seed protectants failed to give some measure of protection against damping-off. Only limited protection was apparent on Larkspur and Dahlia seed. Post-emergence damping-off was not controlled by the seed protectants in these experiments.

An organism, with a pycnidial imperfect stage, was isolated from a diseased Phlox seedling. This organism, by virtue of its perfect stage, was classified in the Aspergillaceae as that family is presently constituted. This organism was shown to be pathogenic and caused damping-off. A new genus and species, Pycnidiophora dispersa, were proposed and described to embrace this organism. The life history and morphology were studied on corn meal agar and potato dextrose agar. Conidium and ascospore germination and hypha development were traced. Pycnidial development was found to be simple meristogenous and the cleistothecium was observed to arise in a similar manner from a few intercalary cells in a single hyphal strand. The thirty-two spored asci, which were scattered throughout the cleistothecial cavity, were produced by crozier formation.

100 pages. $1.25. Mic 56-680

A PHYTOSOCIOLOGICAL STUDY OF TSUGA CANADENSIS AT THE TERMINATION OF ITS RANGE IN WISCONSIN

(Publication No. 14,700)

Harold Arthur Goder, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor John T. Curtis

The western termination of the range of eastern hemlock (Tsuga canadensis (L.) (Carr.)) in the United States lies in north-central Wisconsin. The present study records quantitatively the phytosociological aspects of remaining Tsuga stands at the termination of the border of the species. During summers of 1953 and 1954, 34 stands without severe allogenic disturbances were sampled along the border. The stands were sampled in order to fulfill two objectives: to record the composition of arboreal species and to present a detailed study of Tsuga reproduction and germination habitats.

The dominant species in present day stands are T. canadensis, Acer saccharum, and Betula lutea. Tsuga reproduction was recorded in 32 stands.

Tsuga cones collected in the field had a mean length of 1.8 centimeters and a mean weight of 22.4 grams per 100 cones. Seeds extracted from the cones were germinated in the greenhouse after being given various combinations of treatments. The earliest germination occurred 20 days after the seeds were planted. Germination capacity ranged from 0.1 per cent to 19.8 per cent, varying according to the type of treatment and weight of seeds.

Reproduction capacities and habitats were investigated in the field. Five decay classes were constructed for characteristics of coniferous logs and stumps. High densities of Tsuga seedlings were recorded on logs and stumps in the later classes of decay.

The micro-relief within a stand of Tsuga provides suitable germination habitats. Germination of Tsuga occurs principally on mounds, logs, and stumps rather than intervening areas or pits. From field observations, it was concluded that Tsuga seedlings do not have enough energy to emerge through deciduous leaf matter which accumulates in pits. Successful survival occurs on mounds which have three sources of origin: fallen tree trunk, or stump covered with organic matter, or a mound of disturbed soil.

Within a small area, windthrow is important in providing suitable germination habitats and, consequently, for the perpetuation of Tsuga. Tsuga may remain suppressed for a number of years but once released, grows rapidly.

Records of pre-settlement vegetation were used to ascertain factors which limited the range of Tsuga and to study the past arboreal species composition. Utilizing original land survey books, data were transcribed for each range of townships and each tier of townships along the entire border. Importance Values were computed for all tree species occurring in each township. Trends along the transects which were analyzed indicate that fire was a primary factor controlling the location of the boundary. Populus and Pinus species were used as indicators of the occurrences of fire.

Climatic factors were also considered as limiting the range of Tsuga. In southern Wisconsin relict stands of Tsuga are limited to micro-areas of cool temperature and high moisture conditions. It is not limited to such areas at the termination of its border. Since there are no isopleths which correlate with the entire boundary, the correlation of climatic isolines with segments of the border may be a coincidence.

From the study of pre-settlement vegetation records and present day surveys, it was determined that Tsuga had increased its importance in stands along the border since the time of the land survey, 1834-1858. Tsuga has perpetuated itself along the border and reproduction capacities indicate that it will remain a component of the northern hardwood forests with slight fluctuations in the geographic location of the border. 148 pages. $1.84. Mic 56-681

SORPTION AND FUNGITOXICITY OF RADIOACTIVE POTASSIUM DIMETHYL- AND DI-N-PROPYLDITHIOCARBAMATES

(Publication No. 14,481)

George Donald Munger, Ph.D.
The Ohio State University, 1955

Adviser: C. C. Allison

The object of this investigation was to obtain radiotracer data relating sorption (adsorption and absorption) and fungicidal activity of potassium dimethyl- and di-n-propyldithiocarbamate. The sodium dimethyl derivative was reported not only more toxic to Helminthosporium sativum and Alternaria oleracea but was sorbed to a greater degree than the di-n-propyl homolog, although the sorption difference was not statistically significant. Since extensive evaluation of techniques did not result in an adequate reduction in variation, this research was initiated.

Several major changes were made, following experimentation, to eliminate sources of variability. The potassium salts were used to eliminate the potential influence of sodium on permeability. Although the salts of the derivatives did not vary in fungicidal effect, no comparison of sorption of the sodium and potassium derivatives was made.

Variation in fungicidal effectiveness was lessened by harvesting spores dry rather than washing conidia from the culture surface. Because of continued variability in germination of A. oleracea spores, this fungus was replaced with Monilinia fructicola, in radiotracer work.

Variation in the carbon nutrition of H. sativum could result in marked variation in susceptibility to the dimethyl derivative. Spores harvested from media containing galactose, lactose, and starch were most resistant at 2×10^{-4} molar concentration of the dimethyl derivative. Since spores from such media were larger than those from other carbon sources, this difference might be explained on a spore volume-toxicant basis. Although this would appear a reasonable interpretation, results from investigations with glucose concentrations are evidence against such a relationship. Spore size, in general, increased with decrease in glucose concentrations, from 4.0 to 0.5 per cent, susceptibility to the dimethyl compound being similar at the various levels tested.

Cellulose filter discs were an important source of variation in tracer investigations. Since filtration pressure was not associated with this variability, other sources were examined. Spore loss and poor spore distribution on the

filter surface contributed to variation in radioactivity measurements. One of the most important sources of variation was considered to be differences in noncellulosic constituents in the filter paper discs. Although variation could be reduced by boiling the filters in ammonium chloride and subsequently in deionized water, the pores of the cellulose paper were so greatly enlarged that smaller spores passed through the filter. Consequently, a new filter apparatus was designed. The unit was fitted with a plastic "Millipore" filter on which the spores were collected. This membrane, on which the spores were uniformly deposited, could be easily removed from the filter assembly for radioactivity measurements.

S^{35} - labelled potassium dimethyldithiocarbamate at $1x10^{-3}$ molar was more fungicidal to spores of both M. fructicola and H. sativum than the corresponding salt of the di-n-propyl homolog. Sorption of the dimethyl compound, however, was significantly less than that of the di-n-propyl derivative. This difference in sorption was evident following exposure periods as short as 5 minutes. The same relative differences occurred when spores were heat-killed before exposure to the compounds. Furthermore, adsorption of the dimethyl homolog on the plastic filter was consistently less than that of the di-n-propyl compound. In addition, although considerably greater amounts of the di-n-propyl homolog were sorbed by the spores and by the "Millipore" membrane, washing desorbed a greater proportion of the dimethyl compound.

Since fungitoxicity of the two compounds did not correspond to their sorption characteristics, it remains to be determined whether fungicidal activity is directly related to absorption (permeation). In any case two possibilities are apparent; 1) the di-n-propyl compound, which may or may not be fungicidal, is so strongly adsorbed on the spore wall that permeation of the conidia does not occur in fungitoxic amounts, 2) the di-n-propyl compound permeates the spore in relatively large amounts but is relatively nonfungicidal at the concentrations tested.

Attempts to locate the site of radioactivity by autoradiography of spore sections were not successful.

51 pages. $1.00. Mic 56-682

PLANT VIRUS LOCAL LESIONS IN RELATION TO OSMOTIC PRESSURE

(Publication No. 15,875)

James David Panzer, Ph.D.
The Ohio State University, 1955

A decrease in virus lesion number was noted when Pinto bean plants were placed in solutions of 1 per cent glucose or 2 per cent sucrose and inoculated with the tobacco mosaic virus (TMV) as compared with plants placed in distilled water. No decrease occurred when plants were placed in 1 per cent sucrose. These data led to an investigation of the effect of osmotic pressure on the number of virus lesions.

In general, lesion number decreased as osmotic pressure increased on Pinto bean plants inoculated with TMV and placed in solutions of glucose, sucrose, or $CaCl_2$. At osmotic pressures of 0.0, 0.6, 1.3, and 2.0 atmospheres, a significant reduction in lesion number occurred only at 1.3 atmospheres when plants were placed in solutions of sucrose, glucose, fructose, maltose, or $CaCl_2$. Significant reduction occurred at 2.0 atmospheres with fructose and $CaCl_2$, and at 0.6 atmospheres with solutions of fructose. In all cases the greatest reduction occurred at 1.3 atmospheres.

An increase in the number of lesions was found when plants were placed in K_2SO_4 solutions of 0.6, 1.3, or 2.0 atmospheres; the smallest increase occurred at 1.3 atmospheres.

Time of inoculation in relation to exposure of plants to solutions of various osmotic pressures was found to affect lesion number, reduction usually not occurring unless the plants were exposed to the solutions at least 2 days before inoculation, although this period varied with the different chemicals tested.

An indirect effect of osmotic pressure on the virus through an alteration of the physiology of the suscept was inferred.

Expressed fluids of leaf tissue of Pinto bean plants placed in solutions of sucrose with osmotic pressures of 0.0, 0.6, and 1.3 atmospheres were 7.169, 8.552, and 11.74 atmospheres respectively. The osmotic pressures of expressed fluids of Pinto bean leaf-blades, petioles, and pulvini were 7.349, 8.913, and 10.66 respectively. When inoculated with TMV, no lesions developed on the pulvini, few on the petioles, and many on the leaf-blades.

When beans of varieties other than Pinto were placed in sucrose solutions of 0.6, 1.3, and 2.0 atmospheres, an increase in lesion number occurred at all treatments.

No lesions developed when Pinto bean seeds germinated in mineral salts and were then transferred to distilled water and inoculated with TMV. When plants were exposed to mineral salt solutions during their entire lives, lesions developed, the greatest number occurring in a complete Meyer's solution followed by -K, -P, and -N.

Tap water was found to reduce the number of lesions indirectly through the precipitation of mineral salts when a slightly acid tap water was used.

No lesions developed when plants were placed for their entire lives in single salt solutions of N, P, K, Fe, or in a micrometabolic element solution.

With respect to a cation series, greatest lesion number occurred in the area of high Mg with low K and Ca, and in the area of high Ca with low Mg and K.

With respect to an anion series, greatest lesion number occurred in the area of high $PO_4^{=}$ with low NO_3^{-} and $SO_4^{=}$.

When plants grew in Meyer's solutions of various osmotic pressures, a significant increase in lesion number occurred at the 0.2 - 0.3 atmosphere region and at 0.6 atmospheres.

Osmotic pressure is discussed as a possible explanation for increases and decreases of lesion number of plants exposed to different environmental conditions such as periods of darkness, various amounts of water, etc., as reported by workers in the field. 71 pages. $1.00. Mic 56-683

STUDIES IN THE AGARIC GENUS VOLVARIELLA

(Publication No. 15,533)

Robert Lynn Shaffer, Ph.D.
Cornell University, 1955

Anyone attempting to identify fungi soon finds that the existing taxonomic treatments of many genera are inadequate. This fact coupled with an interest in the higher basidiomycetes led the author to choose Volvariella, a genus of volvate agarics with pink spores and free lamellae, for taxonomic study.

The genus is most commonly known as Volvaria, but because of problems of homonymy Spegazzini's name, Volvariella, must be used for it. Historical record of the genus perhaps dates from the second century A.D., and throughout the years more than one hundred species and varieties have been described.

Concepts concerning the intergeneric relationships of Volvariella are reviewed. Modern authors place the genus in the tribe Pluteeae of the family Amanitaceae along with Chameota and Pluteus. The division of the genus into sections based on the nature of the pileus surface is discounted, but natural groups containing species of similar morphology and ecological preference can be recognized.

The morphological characteristics, both microscopic and macroscopic, of Volvariella are discussed. It is pointed out that its species are widely distributed ecologically and geographically.

"Volvaria" bresadolae and Volvariella diplasia are cultivated as comestibles in the Orient and in Madagascar, and amateur mycophagists will find Volvariella bombycina, V. speciosa, and V. taylori of interest.

A systematic account of the North American species includes a generic description and a key to and descriptions of sixteen species: Volvariella canalipes (Murr.) comb. nov., V. earlei (Murr.) comb. nov., V. speciosa (Fr. ex Fr.) Sing., V. flaviceps (Murr.) comb. nov., V. jamaicensis (Murr.) comb. nov., V. bakeri (Murr.) comb. nov., V. bombycina (Schaeff. ex Fr.) Sing., V. peckii (Atk. in Pk.) comb. nov., V. surrecta (Knapp) Sing., V. volvacea (Bull. ex Fr.) Sing., V. cubensis (Murr.) comb. nov., V. taylori (Berk.) Sing., V. fimetaria (Murr.) comb. nov., V. alachuana (Murr.) comb. nov., V. umbonata (Pk.) comb. nov., and V. pusilla (Pers. ex Fr.) Sing. Within V. speciosa, var. speciosa and var. gloiocephala (DC. ex Fr.) Sing. are recognized; V. pusilla is divided into two subspecies, subsp. pusilla and subsp. hypopithys (Fr.) stat. nov. Eight imperfectly known species are discussed and are also included in the key. The type of the genus is Volvariella argentina Speg., a synonym of V. pusilla.

A list of approximately 70 species and varieties not described or reported from North America is appended.

112 pages. $1.40. Mic 56-684

HOST-PARASITE PHYSIOLOGY IN RELATION TO CLUB-ROOT DISEASE OF CRUCIFERS

(Publication No. 14,429)

James Eldon Smith, Ph.D.
Purdue University, 1955

Major Professors: John S. Karling and C. L. Porter

Plasmodiophora brassicae Wor., an obligate mycetozoan parasite, is a primitive fungus which multiplies rapidly in the roots of wild and cultivated crucifers and causes the formation of massive, spindle-shaped tumors. It was the purpose of this investigation (a) to determine the pattern of changes in protein nitrogen, soluble nitrogen, DNA, and RNA syntheses during the induction period of these tumors; (b) to compare the overgrowths on the hypocotyl of crucifers caused by P. brassicae and by the crown gall organism, Agrobacterium tumefaciens (strain AT-S-55-6); and (c) to explore the possibility of using excised plant tissues for the maintenance of pure cultures of the fungus.

The germination of resting spores isolated from minced tissue of surface-sterilized galls varied greatly from one spore preparation to the next. The number of spores which germinated depended in part upon the age of the gall tissue from which they were isolated. Spores from young solid galls germinated poorly in sterile media, phosphate buffer, and distilled water. Significantly better germination was obtained in nonsterile soil extracts. The factor responsible for increased germination was shown to be associated with the micro-organisms in the soil. It could be duplicated by treating the spores with trypsin, pepsin, commercial pancreatic extract, or a crude proteinase preparation from mixed cultures of indigenous soil bacteria. The increased germination with enzymes was attributed to the digestion of a protein matrix which remained attached to spores isolated from solid gall tissue.

It was observed that infection of seedling roots is usually greatest when the very youngest root hairs are continuously exposed to the fungus. Infected root tips of cabbage and radish were excised and grown in a glucose-nutrient salts medium supplemented with vitamins. The growth responses of these roots to indole-3-acetic acid (IAA), indole-3-butyric acid (IBA), p-chlorophenoxyacetic acid (POA), and riboflavin were determined. The growth of both infected and uninfected cabbage roots was stimulated by riboflavin and low concentrations of the auxins. These roots increase in length primarily by cell elongation rather than by cell division. Radish roots, on the other hand, had an active apical meristem, but when infected they showed no response to IAA, a slight response to IBA and POA, and a rather strong response to riboflavin. Indole acetic acid and POA increased the transport of nitrogen toward the tips of infected cabbage roots but had little or no effect on its transport in infected radish roots.

These experiments were interpreted as showing that cessation of growth in actively growing radish root cultures resulted from a supraoptimal concentration of auxin caused by the fungus. This would account for the failure of additional auxin to stimulate growth, for the slight stimulation by POA and IBA (which are weak antiauxins under some circumstances), and for the marked increase in growth caused by high concentrations of auxin-destroying riboflavin in the presence of weak light. In excised cabbage roots the apical meristem is relatively inactive, and the auxin supply probably dwindles. Thus, low concentrations of auxins added to these roots are slightly stimulatory.

Chemical analyses of incipient cabbage hypocotyl tumors showed that the general patterns of nucleic acid, protein nitrogen, and total nitrogen syntheses were similar in P. brassicae galls and in Agrobacterium tumefaciens galls. These analyses were made at intervals of 0, 2, 4, 7, 11, 16, and 22 days after wounding and inoculation of the hypocotyl. Throughout this period there is a steady increase in protein nitrogen and soluble nitrogen in both types of galls. Within 2 to 7 days after wounding, the DNA shows a significant rise followed by a rapid decline. As the DNA level drops, RNA synthesis increases. Total DNA

and RNA levels of tumors are higher than their controls, but the ratios of RNA to DNA in them differ. Crown gall tumors tend to have slightly higher ratios than the controls, while club root galls have lower ones. The ratios from period to period vary more in tumors than in controls. Although both protein nitrogen and RNA remain at high levels in gall tissues, the peaks of RNA synthesis were not followed by bursts of protein synthesis.

It was also shown that the size of crown galls and P. brassicae galls on the hypocotyl depended upon how soon after wounding the parasite infected the host.

112 pages. $1.40. Mic 56-685

CHEMISTRY

CHEMISTRY, ANALYTICAL

INVESTIGATION OF THE ANALYTICAL PROPERTIES OF ANTHRANILIC ACID AND ITS DERIVATIVES

(Publication No. 15,841)

William Fred Harris, Ph.D.
The Ohio State University, 1955

The analytical properties of substituted anthranilic acids were studied in order to obtain information leading to the development of selective or specific organic reagents for inorganic analysis.

The pH ranges for precipitation of copper, nickel, cobalt, zinc, and cadmium with anthranilic acid from acetate buffers were determined. In order to do this, rapid and accurate volumetric methods for the analysis of the metal content of the precipitates were developed. In general, this determination involved dissolving the precipitate in HCl and evaporating the solution to near-dryness. For nickel and copper the solutions were made basic with NH_4OH and titrated with a standard Versene solution. Murexide was used as the indicator. Erichrome Black T was used as the indicator for zinc. For cobalt and cadmium it was necessary to add an excess of Versene before making the solution basic. The excess Versene was titrated with a standard zinc solution. Eriochrome Black T was used as the indicator.

Formation constants of copper and cadmium in 50 per cent dioxane with anthranilic acid and the N-methyl, N-phenyl, 3,5-diiodo, 3-methyl, and 5-sulfo derivatives were determined by the Calvin-Bjerrum method. The constants of copper, nickel, cobalt, zinc, and cadmium with 5-sulfo anthranilic acid in water and with NN'ethylene dianthranilic acid in 50 per cent dioxane were also determined.

Substituting groups on the ring or nitrogen of anthranilic acid did not have a marked effect on the stability constants. However, very large increases in the stability constants were noted for NN'ethylene dianthranilic acid.

95 pages. $1.19. Mic 56-686

CHEMISTRY, BIOLOGICAL

STUDIES ON THE INORGANIC EQUILIBRIA IN MILK BY AN ION EXCHANGE RESIN CONTACT-TIME METHOD

(Publication No. 14,939)

June Marshall Baker, Ph.D.
University of Missouri, 1955

Supervisor: Charles W. Gehrke

Evaporated milk develops undesirable characteristics when stored under abnormal conditions. These characteristics take the form of off-flavor, salt precipitation, gelation, and fat and solids separation. These defects have been considered to be the result of protein instability. The effect of the inorganic constituents upon protein stability has been subject to much study and is a useful approach in studying these defects. An analytical method for the determination of the phase distribution of the inorganic constituents in milk would help clarify the factors which cause the observed abnormalities of processed milks.

A resin contact-time method (RCTM) has been developed to study the availability of calcium in milk. A quantity of a desirable ion exchange resin is regenerated with a convenient ion. The resin is then contacted with 25 ml. of milk for various periods of time. An analysis of the ions eluted from the resin gives data on the distribution of the ions in the milk and the effect of processing treatments to which the milk has been subjected. In studying inorganic equilibria in milk, this method does not have the limitations of such procedures as ultrafiltration, dialysis or rennet precipitation.

Cation exchange studies reveal that 34.1 per cent of the calcium in skim milk is available for exchange to 20 ml. of the resin Amberlite IRC-50-K in 10 seconds and 95 per cent after 180 seconds' contact. Removal of calcium from true solutions was found to be 98 per cent with contact-times of 20 seconds or longer. The standard deviation for the RCTM was found to be ±0.38 mg. for a range of 10 to 160 seconds, and the calcium removed ranged from 11.16 to 31.08 mg.

The pH of the milk sample contacted was held constant by buffering the resin near the pH of milk (6.70). The control of pH effectively reduced the shifts which occur in the salt equilibria (phosphates and citrates) in milk with changes in pH. The adsorption of anions by Amberlite IRC-50 was found to be negligible.

The results of RCTM measurements on availability of calcium when plotted as the log milliequivalents remaining versus contact-time can be used to obtain a value for ionic calcium. The ionic calcium content of raw skim milk was found to be in the range of 21.8 to 26.2 mg. per cent. The exchange of calcium from skim milk followed a first order reaction through 120 seconds' contact.

Anion exchange contact-time studies were not conclusive because the sample pH was not controllable. Extensive studies were made on pH, stability number, and calcium content.

The effect of heat upon calcium availability is pronounced when milk is heated at 120°C. for 30 minutes. The velocity constant for the exchange of calcium in heat treated skim milk is one-third that for raw milk. Lower temperatures of heating have less effect on calcium availability. A small decrease in the availability of phosphorus was found for milks subjected to heat treatments of 120°C. for 30 minutes.

Availability of calcium for exchange in stored evaporated milks showed a gradual decrease over a storage time of one year at room temperature (average 77.1°F.); however, samples stored at 40°F. indicated little change in exchangeable calcium.

A desirable evaporated milk is concluded to be dependent upon rate of availability of calcium, and the ionic calcium in the raw milk. The rate at which inorganic equilibria shifts occur largely determines protein stability. Suggestions for future work on this problem are included.

179 pages. $2.24. Mic 56-687

THE ISOLATION AND CHARACTERIZATION OF GLUTAMIC DEHYDROGENASE FROM LEAVES

(Publication No. 15,819)

William Alfred Bulen, Ph.D.
The Ohio State University, 1955

Higher plants receive their nitrogen requirement in inorganic forms which, it is believed, are reduced to ammonia before being converted to the amino group of various amino acids. In an effort to substantiate the enzymatic conversion of ammonia to amino nitrogen in leaves in which the required energy could be supplied either directly or indirectly through photosynthetic processes, glutamic dehydrogenase, an enzyme catalyzing the reversible oxidative deamination of glutamic acid, was isolated from young corn leaves. The synthesis of glutamic acid from α-ketoglutaric acid and ammonia was demonstrated with the partially purified enzyme.

Purification of the enzyme was effected by two ammonium sulfate fractionations followed by adsorption on calcium phosphate gel. Optimal conditions for the spectrophotometric assay of enzyme activity following the oxidation or reduction of the pyridine nucleotide coenzyme are described.

The leaf enzyme functions optimally at pH 8.1 in two different buffers. It exhibits a coenzyme specificity for diphosphopyridine nucleotide and a substrate specificity for L-glutamate. Hydroxylamine will not replace ammonia as substrate. The effect of substrate concentration on reaction rate was investigated, and Michaelis constants are given for reduced diphosphopyridine nucleotide, α-ketoglutaric acid, and ammonia.

Inhibitor studies with sulfhydryl-binding reagents demonstrated the importance of sulfhydryl groups for enzyme activity. The enzyme was not inhibited by cyanide or hydroxy acids but was inhibited by hydroxylamine.

The lack of a significant decrease in specific activity following dialysis against cyanide indicated that the enzyme does not contain a metal cofactor.

The physiological significance of glutamic dehydrogenase in the nitrogen metabolism of higher plants is discussed.

77 pages. $1.00. Mic 56-688

ELECTROPHORETIC ANALYSES OF PROTEIN FRACTIONS EXTRACTED FROM AN INBRED AND A HYBRID VARIETY OF CORN

(Publication No. 15,398)

Alfred Duncan Campbell, Ph.D.
Purdue University, 1950

Major Professor: Dr. E. T. Mertz

Samples of two varieties of corn, inbred H5 and hybrid US13, and samples of the germ and endosperm of US13, were fractionated by successive exhaustive extractions with phosphate buffer, dilute alkali, dilute acid and 80% aqueous ethanol.

Of the total nitrogen in inbred H5, 14.6, 52.6, 0.8 and 14.6% were extracted by phosphate buffer, dilute alkali, dilute acid and 80% ethanol, respectively. A total of 82.6% of the total nitrogen of inbred H5 was extracted by the various solvent treatments. The remaining 17.4% of the total nitrogen could not be extracted and therefore could not be subjected to electrophoretic analysis. It was observed that a slight increase in the normality of the dilute alkali caused a marked increase in the amount of nitrogen extracted. Direct extraction of inbred H5 with 60% ethanol removed 35.8% of the total nitrogen.

Of the total nitrogen in hybrid US13, 20.2, 48.4, 0.13 and 2.2% were extracted by phosphate buffer, dilute alkali, dilute acid and 80% ethanol, respectively. A total of 70.9% of the total nitrogen of hybrid US13 was extracted by the various solvent treatments. The remaining 29.1% of the total nitrogen could not be extracted by the mild treatments used. Direct extraction of hybrid US13 with 60% alcohol extracted 33.23% of the total nitrogen.

Of the total nitrogen in the endosperm of hybrid US13, 9.7, 71.3, 1.1 and 1.4% were extracted by phosphate buffer, dilute alkali, dilute acid and 80% ethanol, respectively. These treatments removed 83.5% of the total nitrogen in the endosperm.

By extracting the germ of hybrid US13 with phosphate buffer and dilute alkali, a total of 43.5% of the nitrogen was extracted. Of this total, the phosphate buffer removed 29.2% and the dilute alkali removed 14.3%.

The fractions obtained by the above extractions were analyzed in a Tiselius electrophoresis apparatus. The phosphate buffer extracts were run in phosphate buffer (pH 6.0, ionic strength 0.2), and the remaining fractions (the dilute alkali and ethanol extracts) were run in a glycine-sodium chloride-sodium hydroxide buffer (pH 12.8). Separate samples of each fraction were run twice, once with the current passing through the cell in one direction and the second time with the current in the opposite direction. In this manner both the components with positive and with negative mobilities were detected.

Certain differences between the two varieties of corn were observed in the electrophoresis patterns. A fast

moving minor component with a negative mobility was found in the phosphate buffer of corn US13, its germ and its endosperm; however, this component was not detected in corn H5. There were two main components with positive mobilities in the phosphate buffer extract of the two varieties of corn which were common to both varieties.

There was little similarity in the electrophoretic patterns of the dilute alkali extracts of the two corns. It is reasonable to expect that some of these differences were due to the fact that 0.03N NaOH was used in the extraction of H5 and 0.05N NaOH was used in the extraction of US13.

The fractions obtained by extracting the inbred and hybrid samples of corn with 60% ethanol were shown to be electrophoretically identical by running a sample which contained an equal amount of each extract.

It was found in the work with the whole corn, the endosperm and the germ of US13, that some of the components were common to both the germ and endosperm, while other components were found only in the germ or the endosperm.

Examination of the electrophoretic patterns of the various extracts of inbred H5 reveal the presence of at least four components in the phosphate buffer extract, two components in the dilute alkali extract and three components in the alcohol extract. One or more of the components in the alkali and alcohol extracts are probably identical.

Inspection of the electrophoretic patterns of the various extracts of hybrid US13 reveal the presence of at least six components in the phosphate buffer extract, three components in the dilute alkali extract and two components in the alcohol extract.

The electrophoretic patterns of the extracts of the endosperm of US13 reveal at least five components in the phosphate buffer extract and three components in the dilute alkali extract.

The electrophoretic patterns obtained from the phosphate buffer extract and the dilute alkali extract of the germ from US13 show at least six components in the phosphate buffer extract and four components in the dilute alkali extract.

In this study, approximately 82% of the total nitrogen of inbred corn H5 and approximately 71% of the total nitrogen of hybrid corn US13 have been subjected to an electrophoretic analysis and the mobilities of the various components determined. An interpretation of the electrophoretic data is presented, and possible avenues of new research are outlined. 88 pages. $1.10. Mic 56-689

STUDIES ON THE MECHANISMS OF GLUCOSE AND ACETATE OXIDATION BY SACCHAROMYCES CEREVISIAE

(Publication No. 15,697)

Norman Ray Eaton, Ph.D.
University of Washington, 1955

The pathways involved in the complete oxidation of glucose, acetate and ethanol by the yeast, Saccharomyces cerevisiae, have been the subject of this investigation.

For the first time, it has been clearly demonstrated that glucose oxidation proceeds via the Embden-Meyerhof-Parnas pathway, followed by the complete oxidation of the resulting two-carbon compound by way of the Krebs cycle.

The occurrence of a hexose-monophosphate "shunt" mechanism as a major respiratory route has been excluded in this system.

Evidence has also been obtained that the ultimate oxidation of glucose is dependent upon an adaptation of these cells involving the Krebs cycle enzymes.

112 pages. $1.40. Mic 56-690

THE DETERMINATION OF THE MOLECULAR WEIGHT OF RABBIT MUSCLE D-GLYCERALDEHYDE-3-PHOSPHATE DEHYDROGENASE BY SEDIMENTATION VELOCITY AND DIFFUSION METHODS AND A STUDY OF THE COENZYME CONTENT

(Publication No. 15,698)

Jay B. Fox, Jr., Ph.D.
University of Washington, 1955

Some of the physical properties of the enzyme D-glyceraldehyde-3-phosphate dehydrogenase from rabbit muscle have been investigated. The protein has been studied by means of sedimentation and diffusion, values of 7.71×10^{-13} sec. and 4.97×10^{-7} cm.^{2} sec.$^{-1}$ being obtained for the sedimentation and diffusion constants, respectively. The partial specific volume has been determined to be 0.725 ml./gm. When these three values are inserted in the Svedberg equation, the molecular weight is calculated to be 136,900. The refractive index increment of the enzyme has been measured and found to be 0.1947 ml./gm. at 5516 Å. and 0.9°C. The isoionic point has been determined by electrodialysis to be 8.27.

From DPN binding studies, the enzyme is found to bind one mole of DPN per 46,000 grams of enzyme, or 3/138,000. It has been found possible to completely remove all of the coenzyme by charcoal column treatment. The extinction coefficients of the apoenzyme thus produced have been determined and are 0.435 and 0.829 cm.^{2} mgm.$^{-1}$ at 260 mμ and 280 mμ, respectively. The extinction coefficients of the apoenzyme-DPN_3 complex have been determined to be 0.922 and 1.002 cm.^{2} mgm.$^{-1}$ at 260 mμ and 280 mμ, respectively.

The enzyme preparations have been examined for homogeneity and have been found to compare favorably with other purified proteins. 99 pages. $1.24. Mic 56-691

STUDIES ON THE BIOSYNTHESIS OF THE PENICILLINS

(Publication No. 15,664)

Edward Seiyu Inamine, Ph.D.
State College of Washington, 1955

By the use of S^{35}-labeled L-cystine it has been demonstrated that cystine is incorporated into the penicillin molecule at a rapid and fairly constant rate over the whole period of penicillin biosynthesis. This result indicates the improbability of detecting intermediates in the mold mycelium or broth which are involved in the biosynthesis of the penicillins from L-cystine.

Studies of rates of incorporation of S^{35}-labeled L-cystine and D-valine-1-C^{14} into penicillin indicate a more rapid and more extensive incorporation of the former. L-Cystine is probably a more direct precursor of penicillin than is D-valine.

Results from competitive utilization studies in short-term experiments show that N,N'diphenylacetyl-L-cystine and L-cystinyl-di-D-valine do not compete with L-cystine to any significant extent as source of sulfur for penicillin biosynthesis. These two compounds appear not to be intermediates in the pathway of penicillin biosynthesis.

L-Methionine, L-cystathionine, benzylpenillic acid, oxidized glutathione and reduced glutathione were found not to compete effectively with L-cystine as source of sulfur for penicillin formation in short-term experiments.

No obvious relationship in the biosyntheses of "free" methionine and penicillin from added S^{35}-labeled inorganic sulfate could be detected even under conditions which should have been ideal for methionine biosynthesis. Indirect evidence obtained indicates that L-cystine serves in preference to sulfate as the sulfur source for the biosynthesis of L-methionine in Penicillium chrysogenum, WIS 48-701.

An attempt to discover a tissue homogenate system capable of synthesizing penicillin was not successful.

Studies with well-washed mycelium show that the 30 to 45 minutes required to wash the mycelial mat did not appear to have any adverse effects on the penicillin-producing capacity of the mold. 42 pages. $1.00. Mic 56-692

STUDIES ON THE CHEMISTRY OF WHEAT LIPIDS

(Publication No. 15,273)

Edward Doyle Slifer, Ph.D.
University of Illinois, 1955

A benzene extract of wheat flour was fractionated into four distinct components by a Craig distribution between n-heptane and 95 per cent methanol. Forty per cent of the extract consisted of a triglyceride fraction which was unique in that it had a saponification number of 250 and an iodine number of 70. A sterol believed to be stigmasteryl palmitate made up 3 per cent of the benzene extract with unesterified sterol making up another 3 to 4 per cent. A lipoprotein making up 14 per cent of the benzene extract was isolated and the peptide moiety was shown to contain at least six amino acids. Three of these were identified as serine, tyrosine, and glutamic acid. The peptide appears to be attached to a phosphatidyl serine residue. Another fraction containing a high concentration of carbohydrate made up 23 per cent of the benzene extract. This material was further fractionated into a "more acetone soluble" and a "less acetone soluble" fraction and the structure of each of these fractions studied extensively. The carbohydrate portion of the component making up the "less acetone soluble" fraction was identified as the α-D-galactopyranosyl-1, 6-β-D-galactopyranosyl-1-glycerol while the carbohydrate portion of the component making up the "more acetone soluble" fraction was identified as β-D-galactopyranosyl-1-glycerol. These two galactosylglycerols appear to exist in the intact fraction with the glycerol completely esterified. 116 pages. $1.45. Mic 56-693

AN INVESTIGATION OF THE OXIDATIVE ENZYME SYSTEMS OF BOVINE SPERMATOZOA

(Publication No. 14,970)

John Thurmond Smith, Ph.D.
University of Missouri, 1955

Supervisor: D. T. Mayer

The harmful effects both of washing and high dilution of spermatozoa have been established by previous investigation, as well as the soluble nature of some dehydrogenases and their coenzymes.

Therefore, the effect of washing four times with isotonic saline and the addition of whole egg yolk and its isolated constituents upon the dehydrogenase activity of bovine spermatozoa has been determined by manometric techniques.

Four times washing of spermatozoa was found to inhibit their glyceraldehyde-3-phosphate dehydrogenase activity while stimulating that of their succinic and malic dehydrogenases. The highly significant inhibition of glyceraldehyde-3-phosphate dehydrogenase activity was apparently independent of seasonal influence and above that which could be removed by the addition of DPN. This part of the total inhibition was believed to be the result of actual removal of this soluble enzyme by the washing of the spermatozoa. Although dependent upon seasonal influences, the stimulation of the succinic dehydrogenase activity of bovine spermatozoa was believed to be the result of DPN from the semen by extensive washing. Whereas the slight, though not significant, stimulation of malic dehydrogenase activity observed was postulated as the result of the removal of DPNase by the washing of the spermatozoa.

The succinic dehydrogenase activity both of washed and unwashed spermatozoa was found to fluctuate in a manner which was significantly correlated with the mean environmental temperature which prevailed at the time of collection of the semen.

Addition of egg yolk both to washed and unwashed spermatozoa stimulated the activity of their succinic, malic, and glyceraldehyde-3-phosphate dehydrogenases. Stimulation of dehydrogenase activity by the addition of egg yolk was believed to be beneficial to spermatozoa survival and persistence of motility, perhaps through the regulatory function of removal of the acid products of glycolysis. This postulate was strengthened by the comparison of the dehydrogenase activity of spermatozoa in heated and unheated milk. Heated milk, a good semen extender, was found to stimulate dehydrogenase activity, while unheated milk, which is spermicidal, was found to inhibit dehydrogenase activity.

Some egg yolk constituents, cholesterol and carotene, stimulated succinic dehydrogenase activity but varied in their effect upon malic and glyceraldehyde-3-phosphate dehydrogenase activity. Cholesterol inhibited the malic and glyceraldehyde-3-phosphate activity of spermatozoa, whereas carotene stimulated the activity of malic dehydrogenase. The inhibition of malic dehydrogenase plus its effect on membrane permeability were given as possible mechanisms whereby cholesterol stimulated bovine spermatozoan succinic dehydrogenase.

118 pages. $1.48. Mic 56-694

PLANT PHOSPHOLIPASE D: I. PREPARATION AND PROPERTIES OF PHOSPHOLIPASE D; II. INHIBITION OF SUCCINIC OXIDASE BY COTTONSEED PHOSPHOLIPASE D.

(Publication No. 14,432)

Harvey Llewellyn Tookey, Ph.D.
Purdue University, 1955

Major Professor: A. K. Balls

The importance of phospholipases is suggested by the ubiquity of phospholipides, which are important components of such diverse materials as erythrocytes, brain tissue, soybeans, and mitochondria. Phospholipase D is widely distributed in the plant kingdom, but has been relatively little studied. It was discovered as recently as 1947 during the course of an investigation of flavor deterioration in dehydrated cabbage.

Before 1948, little work had been done on the effect of phospholipases upon the abundant phospholipide present in mitochondria. Since then considerable interest has been shown in this field. Phospholipases A, C, and now D have been shown to inhibit the mitochondrial succinic oxidase system.

I. Preparation and Properties of Phospholipase D

Phospholipase D has previously been studied primarily as a lecithin-hydrolyzing enzyme. Attempts at purification have so far resulted in confining enzymatic activity to the chloroplast or chromoplast fractions of various plant tissues. No soluble preparations have been reported until this study.

The present experiments have been conducted chiefly by measuring the ethanolamine nitrogen released from soybean phospholipide by phospholipase D preparations from cabbage leaves and cottonseed. This is the first time such an enzyme has been reported from cottonseed. This enzyme is a phospholipase D, because it cleaves phospholipides between the phosphate group and the nitrogen base, releasing free choline and ethanolamine without appreciable release of inorganic phosphate or fatty acid.

An apparently soluble enzyme preparation from cottonseed has been obtained. It is a stable dry product with a specific activity against phosphatidyl ethanolamine 86 times that of defatted cottonseed meal (dry weight basis). An aqueous solution of the enzyme is not sedimented by a centrifugal force of 26,360 x g for 20 minutes. Such centrifugal force is believed to be sufficient for the removal of chromoplasts and mitochondria.

An inhibitor for phospholipase D has been demonstrated to occur in cabbage juice. Large doses of undialyzed enzyme preparation from cabbage-leaf juice had less enzymatic effect than smaller doses. After dialysis this phenomenon disappeared, and the inhibitory material could be recovered from the diffusate. The inhibitor is slowly destroyed by boiling and completely destroyed by ashing. The phospholipase D from cottonseed is not inhibited by this material from cabbage juice.

NaCl exhibited a curious effect upon the cottonseed phospholipase D, being an inhibitor in some concentrations and an activator in others.

Various other characteristics of cottonseed and cabbage phospholipase D are compared.

II. Inhibition of Succinic Oxidase by Cottonseed Phospholipase D

Phospholipases A and C have been shown to inhibit the succinic oxidase system. The present studies have shown that the succinic oxidase system of beef heart is partially inhibited by cottonseed phospholipase D.

Since the cottonseed preparation was not pure, it was necessary to demonstrate that the phospholipase D per se was the inhibitor of succinic oxidase. After experimentation it was concluded that the inhibitor was indeed phospholipase D for the following reasons: (1) The inhibition is enzymatic and is accompanied by the hydrolysis of the phospholipide in the succinic oxidase system. (2) The inhibition is not caused by the end products of the reaction between phospholipase D and succinic oxidase. (3) The inhibition is enhanced in the presence of NaCl, an activator of phospholipase D. (4) The inhibition is decreased in the presence of NaF, an inhibitor of phospholipase D. (5) Soybean phospholipide, when added to the incubation mixture, tends to protect succinic oxidase from phospholipase D, an indication that two substrates are competing for the same enzyme.

The succinic oxidase system is composed of two major parts, succinic dehydrogenase and cytochrome oxidase. Phospholipase D inhibits the succinic oxidase system and, to a lesser extent, both succinic dehydrogenase and cytochrome oxidase.

At the moment there are a number of conflicting theories as to the means by which the phospholipases inhibit succinic oxidase. Experimental results also conflict, probably because different methods have been used. It is hoped that these studies will throw some additional light on the role of the abundant phospholipide of mitochondria.

149 pages. $1.86. Mic 56-695

THE ENZYMATIC DEGRADATION OF CHYMOTRYPSIN WITH THE FORMATION OF AN ACTIVE ENDPRODUCT: CHARACTERIZATION OF THE ENDPRODUCT

(Publication No. 14,437)

Henry Nelson Wood, Ph.D.
Purdue University, 1955

Major Professor: A. K. Balls

Previous studies concerning the oxidation of chymotrypsin using periodate, ultra violet light and tyrosinase have demonstrated that an active oxidized protein may be formed. Other workers have also acetylated crystalline chymotrypsin (as well as other proteinases) obtaining enzymatically active acetylated proteins. It is recognized that exhaustive acetylation, oxidation with chemical agents or ultra violet light will lead to total inactivation of a proteolytic enzyme. The more specific action of oxidative enzymes, would seem on the other hand, to offer a better opportunity for arriving at a single and definite endproduct. In view of the studies of Sizer and Edman, wherein a modified endproduct was obtained after the action of tyrosinase upon chymotrypsin and also from pepsin and trypsin, work was initiated to study the oxidation of chymotrypsin by a peroxidase. Analyses of the horseradish enzyme by paper

electrophoresis showed the presence of several different enzymes, among them a tryptophan oxidase.

Crystalline chymotrypsin was prepared in the conventional manner from the zymogen. A purified preparation of horseradish peroxidase (described in the text) was used as the enzymatic oxidation agent.

Manometric experiments demonstrated that during the oxidation with horseradish enzyme, the uptake of oxygen stopped when one mole of oxygen per mole of chymotrypsin had been used. Chymotrypsinogen could be oxidized under the same conditions. The system contained glucose dehydrogenase, glucose, horseradish enzyme, chymotrypsin, buffer and added catalase. The glucose dehydrogenase system served as a slow but continuous source of hydrogen peroxide, which was thus available in low concentration to the horseradish enzyme for the oxidation of chymotrypsin.

Assays of the oxidized chymotrypsin, measured with tyrosine ethyl ester, showed that about half of the esterase activity had been lost during oxidation.

By means of experiments in dialysis sacs it was possible to oxidize larger samples of chymotrypsin. This enabled the oxidized endproduct to be crystallized. It was also found to have lost 50 percent of its original esterase activity.

Comparisons of the oxidized and native chymotrypsin and chymotrypsinogen by means of paper electrophoresis and infra red analysis indicated differences between them. Chemical analysis of the oxidized endproduct showed a loss of one mole of tryptophan per mole of enzyme and no apparent loss of histidine or tyrosine.

If the foregoing results are compared with those of Weil, who oxidized chymotrypsin by irradiation with ultra violet light, it appears that both peroxidase and light produce a 50 percent inactivation after the uptake of about one mole of O_2 per mole of protein and the loss of about one mole of tryptophan. However, the oxidation by light proceeded beyond this point whereas that by peroxidase did not. When 4 moles of O_2 had been consumed per mole of protein, no activity remained, and three moles of tryptophan plus one mole of histidine had been lost. Moreover, the protein at this stage could no longer be phosphorylated by the commonly used phosphorylating agents such as diphenylchlorophosphate. This is in distinction to the behavior of peroxidase-oxidized chymotrypsin, which accepts just as much phosphorus as the original protein. Accordingly, these data seem to indicate that the tryptophan removed by peroxidase is probably an auxiliary group in the enzyme rather than a necessary group since in its absence esterolysis is still possible. 90 pages. $1.13. Mic 56-696

CHEMISTRY, INORGANIC

THE REACTIONS OF SILANE WITH TRIETHYLZINCATE ANION AND DIBUTYLBORATE (I) ANION

(Publication No. 15,699)

Sidney Gore Gibbins, Ph.D.
University of Washington, 1955

The objectives of this work were to prepare a silyl metallic compound and a silicon-boron bonded compound and to interpret the observations, particularly with respect to the nature of the silicon-hydrogen bond in silane.

The formation of ethyl- and diethyl silanes in reactions with triethylzincate anion demonstrated the hydride character of the hydrogen in silane, a behavior consistent with the displacement reactions of silane derivatives previously observed. The absence of more highly substituted silanes, obtained in reactions with lithium alkyls, was attributed to steric hinderance on the part of both the silane derivative and the triethylzincate anion. The displaced hydride ions probably formed diethylhydridozincate anions. These reactions are all in contrast to the formation of potassium silyl in liquid ammonia, the only reported case of cationoid reactivity of hydrogen in silane. A new interpretation of that reaction is proposed involving hydride displacement by electron pairs present in liquid ammonia solutions of potassium.

Synthesis of a silicon-boron bonded compound was attempted by reactions of potassium dibutylborate (I) with silane and with bromsilane. Potassium dihydridodibutylborate (III) was formed in the silane reaction. Other materials, yet to be identified, must include the silicon-containing portion of the products. Bromsilane reacted with potassium dibutylborate (I) to form primarily silane, tributylborane, and a gum-like, non-volatile material containing both silicon and boron. The presence of almost integral proportions of silicon and boron in the gum indicated a silicon-boron bonded compound. Although silicon-boron bonds were probably formed, disproportionation with respect to both silicon and boron interfered with the isolation of simple and definite products.

81 pages. $1.01. Mic 56-697

A STUDY OF SOME COMPLEXES OF THE TRIPOLYPHOSPHATE ION WITH ALKALI METAL IONS AND COPPER ION AND THE STRENGTH OF ITS ACID IN AQUEOUS SOLUTION

(Publication No. 15,856)

Edward Dan Loughran, Ph.D.
The Ohio State University, 1955

It was established that the tripolyphosphate ion forms complexes of the type, $MeP_3O_{10}^{4-}$, with the alkali metal ions, sodium, potassium, and lithium. Values of the complexity constants of these complexes were determined at 25°C. and unit ionic strength. The complex formation equilibria for sodium, potassium, and lithium ions with tripolyphosphate ion, and the corresponding complexity constants, are:

$$Li^+ + P_3O_{10}^{5-} \rightleftharpoons LiP_3O_{10}^{4-} \quad K_{Li} = \frac{(LiP_3O_{10}^{4-})}{(Li^+)(P_3O_{10}^{5-})} = 10^{2.71}$$

$$Na^+ + P_3O_{10}^{5-} \rightleftharpoons NaP_3O_{10}^{4-} \quad K_{Na} = \frac{(NaP_3O_{10}^{4-})}{(Na^+)(P_3O_{10}^{5-})} = 10^{1.78}$$

$$K^+ + P_3O_{10}^{5-} \rightleftharpoons KP_3O_{10}^{4-} \quad K_{K} = \frac{(KP_3O_{10}^{4-})}{(K^+)(P_3O_{10}^{5-})} = 10^{1.38}$$

In addition, the data indicated a weak complex, $LiHP_3O_{10}^{3-}$, and a value of $10^{1.13}$ was obtained for K_{LiH}.

The formation of two complexes of copper(II) ion with tripolyphosphate was established. The equilibria and the

corresponding complexity constants at 25°C. and unit ionic strength are:

$$Cu^{2+} + P_3O_{10}^{5-} \rightleftharpoons CuP_3O_{10}^{3-}$$

$$K_1 = \frac{(CuP_3O_{10}^{3-})}{(Cu^{2+})(P_3O_{10}^{5-})} = 10^{9.84}$$

$$Cu^{2+} + 2P_3O_{10}^{5-} \rightleftharpoons Cu(P_3O_{10})_2^{8-}$$

$$K_2 = \frac{(CuP_3O_{10}^{8-})}{(Cu^{2+})(P_3O_{10}^{5-})^2} = 10^{13.50}$$

The existence of a mixed complex, $CuenP_3O_{10}^{3-}$, in solutions containing nearly the stoichiometric amounts of copper, ethylenediamine, indicated by "en," and tripolyphosphate was established. The formation of the complex from the parent species can be written as follows:

$$Cu^{2+} + en + P_3O_{10}^{5-} \rightleftharpoons CuenP_3O_{10}^{3-}$$

The value of the formation constant at 25°C. and unit ionic strength was found to be

$$K_m = \frac{(CuenP_3O_{10}^{3-})}{(Cu^{2+})(en)(P_3O_{10}^{5-})} = 10^{20.09}$$

Spectrophotometric experiments indicated that a complex, $Cuen_2P_3O_{10}^{3-}$, forms in solutions containing a moderate excess of both ligands. The postulated equilibrium is

$$Cu^{2+} + 2en + P_3O_{10}^{5-} \rightleftharpoons Cuen_2P_3O_{10}^{3-}$$

The value of the complexity constant, calculated from potential measurements at 25°C. and unit ionic strength, was found to be

$$K_{m_2} = \frac{(Cuen_2P_3O_{10}^{3-})}{(Cu^{2+})(en)^2(P_3O_{10}^{5-})} = 10^{23.33}$$

The acid dissociation constants for tripolyphosphoric acid, $H_5P_3O_{10}$, were determined in a non-complexing medium at 25°C. and unit ionic strength. The values, calculated using pH measurements, are as follows:

$$K_1 \sim 1 \; ; \; K_2 = 10^{-.91} \; ; \; K_3 = 10^{-1.63} \; ;$$

$$K_4 = 10^{-5.72} \; ; \; K_5 = 10^{-8.75}$$

The thermodynamic values for K_4 and K_5, extrapolated to infinite dilution at 25°C., are $10^{-6.10}$ and $10^{-9.12}$ respectively.

84 pages. $1.05. Mic 56-698

CHEMISTRY, ORGANIC

THE ACTION OF PERIODATE ION ON 1,3-DIKETONES

(Publication No. 15,814)

James McCue Bobbitt, Ph.D.
The Ohio State University, 1955

It was found that certain 1,3-diketone structures were readily oxidized by the periodate ion in aqueous solution at 25° or below.

A series of 1,3-diketones, of various structural types, was subjected to the action of the periodate ion. In general, the extent of reaction was measured by the assay of oxidant consumption and of acid production. In each case, the products of reaction were isolated and positively identified. Where applicable, measurements were made of carbon dioxide evolution and volatile acid formation.

As a result of this experimental work, the following results and conclusions were obtained:

1. It has been shown that five- and six-membered cyclic 1,3-diketones with no substituents on carbon-2 are oxidized by periodate ion in water solution to give carbon dioxide quantitatively and substituted dibasic acids. Thus, 1,3-cyclohexanedione, 5-methyl-1,3-cyclohexanedione, 5,5-dimethyl-1,3-cyclohexanedione, 1,3-cyclopentanedione, and 1,3-indandione each reduce four molar equivalents of periodate ion to produce carbon dioxide and the dibasic acids, glutaric, 3-methylglutaric, 3,3-dimethylglutaric, succinic, and phthalic respectively.
2. The 2-substituted-1,3-cyclohexanediones, 2-methyl, 2-ethyl, and 2-benzyl have been shown to reduce three molar equivalents of periodate ion to yield in each case quantitative amounts of glutaric acid and the monobasic acids, acetic, propionic, and phenylacetic respectively.
3. The diketone, d,l-2-acetylcyclohexanone, has been shown to reduce periodate ion to give some adipic acid and some carbon dioxide, probably through two different series of reactions.
4. The acyclic diketones, 2,4-pentanedione, 1-phenyl-1,3-butanedione, and 1,3-diphenyl-1,3-propanedione, have been shown to react only very slowly, if at all, with aqueous periodate ion at room temperature or below.
5. A series of reactions and reaction intermediates were derived, based both on experimental results and previous work. In the oxidation of 1,3-cyclohexanedione, the intermediates are (1) 2 hydroxy-1,3-cyclohexanedione, which is largely in its tautomeric form, 2,3-dihydroxy-2-cyclohexenone, (2) 1,2,3-cyclohexanetrione, and (3) 2-keto-adipic acid. The compounds, 2,3-dihydroxy-2-cyclohexenone and 1,2,3-cyclohexanetrione, were prepared and subjected to periodate oxidation to yield carbon dioxide and glutaric acid as predicted. The intermediates were shown to oxidize faster than the starting diketone. In addition, one of the intermediates in the oxidation of 1,3-indandione, phthalonic acid, was isolated and positively identified.
6. The oxidation of these cyclic 1,3-diketones has been found to take place between pH 3 and 8 with maximum rates between 5 and 6.
7. The relative rates of oxidation of the different diketones were investigated. The only definite conclusion was that 1,3-cyclopentanedione was oxidized much more slowly than the cyclohexane derivatives.
8. The kinetics of the reaction were studied and found to be strictly second order at low concentrations, first order with respect to each reactant.

182 pages. $2.28. Mic 56-699

PART ONE: THE WAGNER-MEERWEIN REARRANGEMENT OF THE DIASTEREOISOMERIC 1-ANISYL-1-PHENYL-2-PROPANOLS. PART TWO: THE STEREOCHEMISTRY OF THE ADDITION OF PERBENZOIC ACID TO SOME SUBSTITUTED STILBENES. PART THREE: SOME ANOMALOUS REACTIONS OF PERACIDS.

(Publication No. 15,733)

Arthur Edward Bradley, Ph.D.
Columbia University, 1952

Part One describes the preparation of the 1-anisyl-1-phenyl-2-propanols from anisylphenylacetaldehyde. The two diastereoisomers(A and B) were separated by fractional crystallization of their phthalate esters, and each was found to undergo molecular rearrangement when its p-bromobenzenesulfonate ester was solvolyzed in acetic acid containing one mole of potassium acetate. The products were identified as acetates of the diastereoisomers of 1-phenyl-2-anisyl-1-propanol(A′ and B′) by chromic acid oxidation, showing that the p-methoxyphenyl group had migrated in both isomers in preference to phenyl.

The B brosylate was converted exclusively to the B′ acetate. The stereospecificity of the A brosylate acetolysis was less complete, the main product(A′ acetate) being accompanied by lesser amounts of B′ acetate and olefin. In a crude comparative rate study, in which a first order reaction was assumed, the B brosylate was found to solvolyze about twice as fast as the A isomer. In consideration of these results, and the most probable mechanism for the Wagner-Meerwein rearrangement, tentative configurational assignments were made for A, A′, B, and B′.

One of the isomers(here designated as threo-) would be expected to pass through an intermediate state in which a phenyl and methyl are forced into close proximity. The near identity of the rates of erythro- and threo-isomers was interpreted as an indication that the highest energy point(transition state) was reached before the bulky groups became co-planar. The lack of stereospecificity in the rearrangement of A, however, was attributed to the instability of the threo-intermediate.

Parts Two and Three of this thesis are concerned with peracid oxidation of olefins. In an attempt to prepare the epoxide, trans-p-methoxystilbene was treated with perbenzoic acid, following a procedure in the literature. The product was a glycol monobenzoate, however, which was hydrolyzed to a hydrobenzanisoin that was identified as threo- from its preparation via an osmium tetroxide oxidation of the trans-olefin. Similarly, cis-p-methoxystilbene gave the erythro-glycol by both routes, showing that perbenzoic acid added to the double bond with an overall retention of configuration. The cis- and trans-p-methoxy-p′-methylstilbenes gave completely analogous results.

A procedure was developed for preparing the trans-p-methoxy- and p-methoxy-p′-methylstilbene epoxides by solvolysis of the corresponding dibromides in a mixture of acetone and aqueous sodium carbonate. Each oxide was found to add benzoic acid very rapidly to give the threo-glycol monobenzoate. The proposed mechanism of the perbenzoic acid reaction therefore included intermediate formation of the oxide followed by opening with benzoic acid via a molecular complex that required a cis-orientation of the groups.

The products of the perbenzoic acid oxidation of 1-anisyl-1-phenylethylene were also investigated. At room temperature two moles of peracid were consumed, with the production of anisylphenyl-α-hydroxyacetaldehyde. This was evidently formed by attack of peracid on the epoxide, for when the addition was carried out at -10°, the latter was stable enough to be converted to anisylphenylacetaldehyde by aqueous sodium bisulfite. A monobenzoate and a dioxane were also isolated from the reaction.

In performic acid, 1-anisyl-1-phenylethylene was cleaved to p-methoxyphenol and acetophenone, products which suggested intermediate, formation of a hydroperoxide. It was proposed that the normal course of peracid oxidation was altered by the preliminary formation of the anisylphenylmethyl carbonium ion, and this appeared to be confirmed when 1-p-chlorophenyl-1-phenylethylene gave the expected glycol monoformate under the same conditions. With perbenzoic acid, the p-chloro-olefin gave a mixture of products that included p-chlorobenzophenone.

163 pages. $2.04. Mic 56-700

PERFLUORINATED COMPOUNDS

(Publication No. 15,818)

Robert Raymond Brown, Ph.D.
The Ohio State University, 1955

INTRODUCTION

The work is a study of ways to improve the synthesis of hexafluoroacetone reported by Henne, Shepard, and Young (J. Am. Chem. Soc., 72, 3577) and to investigate other reaction sequences which might lead to this perfluorinated ketone.

A study has been made to determine whether hexafluoroacetone and other perfluorinated ketones can be made by the condensation of perfluoroalkylmetal halides with perfluorinated esters, acyl halides, or acid anhydrides. This work includes an investigation of perfluoro-n-propylzinc iodide and its behavior toward ethyl perfluoro-n-butyrate, isoamyl perfluoroacetate, acetophenone, benzaldehyde, and acetic anhydride.

The synthesis of hexafluoroacetone reported by Henne, Shepard, and Young involved the permanganate oxidation of $(CF_3)_2C{=}CCl_2$ in 60 per cent yield. The needed olefin was obtained from $CF_3C(CH_3)ClCH_2Cl$ in a sequence of steps which gave 90-95 per cent yield each when the unreacted reagents were reworked. The $CF_3C(CH_3)ClCH_2Cl$ was prepared practically quantitatively from trifluoroacetic acid, and is also obtainable from isocrotyl chloride by a sequence of simple steps which would be cheaper for larger quantities. It was proposed to study this method of synthesizing hexafluoroacetone and to improve it by substituting shorter sequences of reactions and by improving the yield of the final oxidation step.

The possibility of preparing hexafluoroacetone by the bromination of hexafluoropropane was investigated. If dibromohexafluoropropane, $CF_3CBr_2CF_3$, could be prepared, it should readily form a semicarbazone or 2,4-dinitrophenylhydrazone from which hexafluoroacetone might be recovered by hydrolysis.

EXPERIMENTAL

Reactions of Perfluoro-n-propylzinc Iodide

A study of C_3F_7ZnI showed it to be very unreactive toward such compounds as ethyl perfluoro-n-butyrate, isoamyl perfluoroacetate, benzaldehyde, acetophenone, and acetic anhydride. There was some indication of reaction with acetophenone and acetic anhydride, but to such a small degree that this route would be impracticable to obtain fluorinated ketones. The reaction with benzaldehyde produced obvious side products, and the reaction with the oxygenated perfluoro compounds gave no indication of any product.

Synthesis of Hexafluoroacetone

The preparation of trifluoroisobutane and its chlorinated analogs led to new, shorter sequences for synthesizing hexafluoroacetone. The preparation of trifluoroisobutene has been described previously. From this fluorinated olefin the following sequences of reactions are described:

$$CF_3-\overset{CH_3}{\overset{|}{C}}=CH_2 \xrightarrow[Pt]{H_2} CF_3-\overset{CH_3}{\overset{|}{C}}H-CH_3 \xrightarrow{Cl_2} CF_3-\overset{CH_3}{\overset{|}{C}}Cl-CCl_3 \quad \text{(43\% yield)},$$

$$CF_3-\overset{CCl_3}{\overset{|}{C}}H-CHCl_2 \text{ and } CF_3-\overset{CCl_3}{\overset{|}{C}}H-CCl_3 \quad \text{(53\% yield)}$$

(1) $CF_3-\overset{CH_3}{\overset{|}{C}}Cl-CCl_3 \xrightarrow{Zn} CF_3-\overset{CH_3}{\overset{|}{C}}=CCl_2$ This can be converted to $CF_3-CO-CF_3$ in 4 steps by Shepard's method.

(2) $$CF_3-\overset{CCl_3}{\overset{|}{C}}H-CHCl_2 \xrightarrow[\text{alcohol}]{KOH} CF_3-\overset{CCl_3}{\overset{|}{C}}=CHCl \xrightarrow[SbF_3Cl_2]{SbF_3} CF_3-\overset{CF_3}{\overset{|}{C}}=CHCl \xrightarrow{KMnO_4} CF_3COCF_3$$

(3) $$CF_3-\overset{CCl_3}{\overset{|}{C}}H-CCl_3 \xrightarrow[\text{alcohol}]{KOH} CF_3-\overset{CCl_3}{\overset{|}{C}}=CCl_2 \xrightarrow[SbF_3Cl_2]{SbF_3} CF_3-\overset{CF_3}{\overset{|}{C}}=CCl_2 \xrightarrow{KMnO_4} CF_3COCF_3$$

The chlorination can be stopped to give approximately 4 parts of $CF_3-\overset{CCl_3}{\overset{|}{C}}H-CHCl_2$ to 1 part of $CF_3-\overset{CCl_3}{\overset{|}{C}}H-CCl_3$. The final oxidation step was developed to a yield of 80 per cent, with 7 per cent recovery of the starting olefin.

Bromination of Hexafluoropropane

The resistance of $CF_3CH_2CF_3$ to bromination was demonstrated by its failure to react with N-bromosuccinimide in either glacial acetic acid or nitrobenzene, or with bromine in the presence of aluminum bromide.

CONCLUSIONS

The preparation of trifluoroisobutane and its subsequent chlorination leads to three new sequences for making olefins which can be oxidized to hexafluoroacetone. The final oxidation step can be carried out in 80 per cent yield in contrast to the previously reported 60 per cent.

74 pages. $1.00. Mic 56-701

THE SYNTHESIS OF THE GEOMETRICAL ISOMERS OF 1,2,3- AND 1,2,4-TRIMETHYLCYCLOHEXANE

(Publication No. 15,820)

Jack Francis Bussert, Ph.D.
The Ohio State University, 1955

There exists in the chemical literature a paucity of information on the geometrical isomers of 1,2,3-trimethylcyclohexanes. The literature does contain several references to the 1,2,4-trimethylcyclohexanes; however, the physical constants reported therein serve merely to point up the confusion which exists.

The research describes the synthesis of each of the three geometrical isomers of 1,2,3-trimethylcyclohexane, and also the synthesis of each of the four geometrical isomers of 1,2,4-trimethylcyclohexane. Definitive physical constants and an infrared spectrogram are reported for each isomer.

The experimental work reported here amplifies the stereospecificity of (1) the Diels-Alder Reaction, (2) lithium aluminum hydride reductions of some anhydrides, esters, and acids, and (3) lithium aluminum hydride hydrogenolysis of several mono- and di-p-toluenesulfonates. The lack of stereospecificity of the hydrogenations of several polysubstituted cycloölefins over (1) nickel-on-kieselguhr catalyst at 140-150°C. and (2) Adams' platinum oxide catalyst at 25°C. is reported. In the course of this research 49 new compounds were prepared and described. The elemental analyses of most of these are presented, as are the more common tautomeric forms (low energy) of each of the geometrical isomers of 1,2,3-, 1,2,4-, and 1,3,5-trimethylcyclohexane. 164 pages. $2.05. Mic 56-702

SYNTHETIC ROUTES TO ISOPRENOID COMPOUNDS

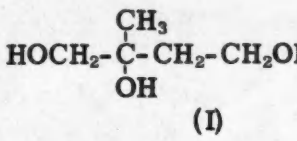
(Publication No. 15,005)

Mohindra Singh Chadha, Ph.D.
Cornell University, 1955

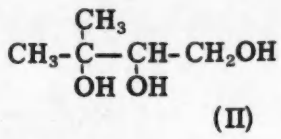
The mechanism of rubber formation in various plants is an important aspect of the problem dealing with the biogenesis of isoprenoid compounds. The present work has been directed mainly to the synthesis of possible precursors or intermediates which may be involved in the phytosynthesis of rubber, for the purpose of testing them in plant growth experiments. The compounds chosen for study were isoprenoid triols, tetrols and C_5 and C_6 isoprenoid carboxylic acids.

The isoprenoid triols through biochemical oxidations, reductions or through cleavage could perhaps lead to the formation of rubber precursor(s). The synthesis of four isomeric methylbutane triols, namely, 2-methylbutane-1,2,4-triol (I), 3-methylbutane-1,2,3-triol (II), 2-methylbutane-1,2,3-triol (III) and 3-methylbutane-1,2,4-triol (IV) was therefore undertaken.

2-Methylbutane-1,2,4-triol (I) was prepared by the reaction of 3-methyl-3-buten-1-ol or its acetate with performic or peracetic acid, followed by ester interchange of the intermediate hydroxy ester. Ester interchange was found to be more efficient than the saponification of the intermediate esters with aqueous bases.



(I)



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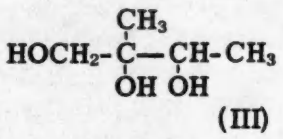

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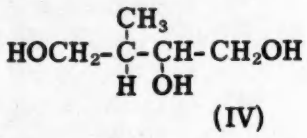
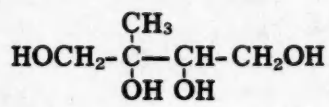


(IV)

3-Methylbutane-1,2,3-triol (II) was prepared similarly from 2-methyl-3-buten-2-ol or 3-methyl-2-buten-1-ol acetate using performic acid. Likewise, 2-methylbutane-1,2,3-triol (III) and 3-methylbutane-1,2,4-triol (IV) were obtained from 2-methyl-2-buten-1-ol and 2-methyl-3-buten-1-ol, respectively.

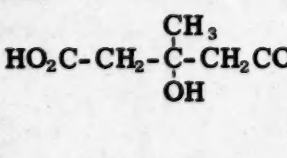
The plant growth tests were made with three triols (I, II and III) in collaboration with the Botany Department, using Cryptostegia grandiflora seedlings grown in an artificial medium. All of these triols were well tolerated by the seedlings and 2-methylbutane-1,2,4-triol appeared to be particularly effective as an organic nutrient. The encouraging results with the triols prompted the investigation of 2-methylbutane-1,2,3,4-tetrol (V), which has the essential features of an isoprenoid skeleton and is related to the naturally occurring sugar apiose in being highly oxygenated and having a branched chain.



(V)

The tetrol was prepared from erythro-2-methylbutane-1,2-3,4-bis-epoxide which was synthesized by two different routes. Better results were obtained by a third route, using hydroxylation of 2-methyl-2-butene-1,4-diol diacetate with performic acid followed by ester interchange.

Investigations of J. Bonner and his collaborators (1) on the biosynthesis of rubber, using guayule cuttings and seedlings, have indicated that 3-methylcrotonic acid and 3-hydroxy-3-methylglutaric acid (VI) are important intermediates in the formation of rubber. The work of Adelberg, Tatum and their coworkers (2) on the biosynthesis of valine and isoleucine in a fungus mutant demonstrated the importance of 2,3-dihydroxyisovaleric acid (VII) and 2,3-dihydroxy-3-methylglutaric acid (VIII) as precursors of the two amino acids. A consideration of these observations led to the synthesis in the present work of the C_5 and C_6 dihydroxy acids (VII and VIII) and the unsaturated acids, cis and trans-3-methylglutaconic acids (IX).



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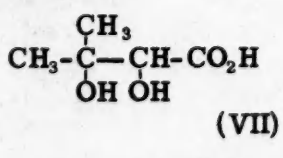

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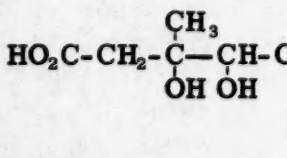

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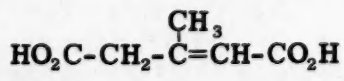

(IX)

2,3-Dihydroxyisovaleric acid (VII) was synthesized from ethyl 2,3-epoxyisovalerate, the product of a Darzens condensation. The 3-methylglutaconic acids (IX) were prepared from diethyl 3-methylglutarate, obtained by treatment of ethyl isodehydroacetate with sodium ethoxide.(3) The cis-acid was prepared also from diethyl 3-hydroxy-3-methylglutarate. The synthesis of 2,3-dihydroxy-3-methylglutaric acid (VIII) was carried out by hydroxylation of 3-methylglutaconic acid. Of the several procedures tested the only successful method was the treatment of trans-3-methylglutaconic acid with sodium chlorate in the presence of osmium tetroxide. The liquid product obtained in this way is believed to be a mixture of threo-2,3-dihydroxy-3-methylglutaric acid and its γ-lactone.

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2. a) E. A. Adelberg, D. M. Bonner and E. L. Tatum, J. Biol. Chem., 190, 837 (1951).

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3. F. R. Goss, C. K. Ingold and J. F. Thorpe, J. Chem. Soc., 123, 327 (1923). 109 pages. $1.36. Mic 56-703

UNSYMMETRICAL TETRAALKYLMETHANES

(Publication No. 14,959)

Homer Haynes Farmer, Ph.D.
University of Missouri, 1955

Supervisor: Dr. Norman Rabjohn

This investigation was undertaken to develop general methods for the preparation of unsymmetrical tetraalkylmethanes which contain between twenty and thirty carbon atoms. In all five hydrocarbons were prepared utilizing two aliphatic acids as intermediates.

The first acid, 4-ethyl-4-methylcaprylic acid, was synthesized by the cyanoethylation of 2-ethylhexaldehyde and the reduction of the resulting 2(β-cyanoethyl)-2-ethylhexaldehyde by the Huang-Minlon modification of the Wolf-Kishner reaction to 4-ethyl-4-methylcaprylic acid.

The two hydrocarbons which were prepared from this acid intermediate were 5-ethyl-5-methyldecane and 5-ethyl-5-methyltetracosane. The former was obtained by the reaction of diethylcadmium with 4-ethyl-4-methylcaprylyl chloride to produce 6-ethyl-6-methyl-3-decanone, followed by the reduction of this ketone with hydrazine and potassium hydroxide in diethylene glycol to the hydrocarbon. The latter of the above mentioned two tetraalkylmethanes was synthesized by means of a Kolbe electrolysis reaction in which 4-ethyl-4-methylcaprylic acid was caused to couple with stearic acid.

The second acid intermediate was prepared by the following sequence of reactions. Methyl ethyl ketone was made to condense with two moles of ethyl cyanoacetate in the presence of alcoholic ammonia to give 3-ethyl-3-methyl-2,4-dicyanoglutarimide. This imide was hydrolyzed with 65 per cent sulfuric acid to 3-ethyl-3-methylglutaric acid. The half methyl ester of this β-disubstituted glutaric acid was caused to couple with capric acid by means of the Kolbe electrolysis reaction to produce 3-ethyl-3-methyltridecanoic acid.

The ethyl ester of this sixteen carbon acid was treated with two moles of ethylmagnesium bromide, the resulting tertiary alcohol dehydrated, and the olefin reduced to 8-ethyl-8-methyl-6-pentyloctadecane.

The acid chloride prepared from 3-ethyl-3-methyltridecanoic acid was caused to react with didecylcadmium to produce 11-ethyl-11-methyl-13-tricosanone which was reduced to the secondary alcohol by means of hydrogen and Raney Nickel. The alcohol was dehydrated and the resulting olefin was again reduced with hydrogen and Raney Nickel to yield 11-ethyl-11-methyltricosane. A similar series of reactions in which didodecylcadmium was used led to 11-ethyl-11-methylpentacosane.

Infrared absorption curves, freezing points and viscosity data at 100° and 210° F. were determined on each of the hydrocarbons. 111 pages. $1.39. Mic 56-704

A STUDY OF THE VOLATILE MATTERS PRODUCED BY THE AUTOXIDATION OF METHYL OLEATE, OLEIC ACID, AND CIS-9-OCTADECENE

(Publication No. 15,832)

Carl Walter Fritsch, Ph.D.
The Ohio State University, 1955

The reaction of atmospheric oxygen with unsaturated fatty acids and glycerides produces hydroperoxides which decompose or react with additional oxygen to yield low molecular (volatile) scission products. It was hoped that characterization of some of the volatile autoxidation products would lead to a better understanding of rancidification of fats.

Methyl oleate, oleic acid, and cis-9-octadecene were used as autoxidation substrates. Methyl oleate was obtained from the mixed methyl esters of olive oil by fractional distillation and purified by low-temperature crystallization. Oleic acid was prepared by the hydrolysis of the purified methyl oleate. Cis-9-octadecene was synthesized by reducing ethyl oleate with lithium aluminum hydride, brominating the oleyl alcohol, and reducing the oleyl bromide to the hydrocarbon.

The substrates were oxidized up to 21 days at 80° C. with a stream of air. The volatile products were condensed in dry-ice traps and examined upon the completion of each run. The volatile substances had a typical rancid odor and consisted of an oily phase, an aqueous fraction, and a crystalline product.

The main constituents of the aqueous fractions were chromatographically determined to be formic acid, acetic acid, and traces of other carboxylic acids. When the amounts of formic and acetic acid isolated were plotted against time of autoxidation, a typical sigmoid type of curve was obtained. Oleic acid, after 14 days of autoxidation, produced an average of 0.08 moles of formic acid and 0.01 moles of acetic acid per mole of substrate. From methyl oleate and cis-9-octadecene, 0.13 and 0.16 moles of formic acid and 0.020 and 0.025 moles of acetic acid, respectively, were obtained. Formic acid could be detected in small amounts even at very early stages of autoxidation.

The peroxidic crystals isolated from the volatile autoxidation products could be recrystallized from small amounts of alcohol at -20° C. The purified crystals melted between 50 and 60°C. and liberated iodine only slowly from potassium iodide in glacial acetic acid. The mean molecular weight based on the peroxide value was 317. The crystals were neutral, but produced acids on standing, and gave a positive, 2,4-dinitrophenylhydrazine test. A sample of hydroxyheptyl peroxide, synthesized from heptanal and hydrogen peroxide in dry ether, showed very similar chemical and infrared properties. When the unknown crystals and a sample of hydroxyheptyl peroxide were decomposed at room temperature, primarily caprylic, enanthic, and formic acid were obtained from the former, and enanthic and formic acid from the latter. It was therefore concluded that the unknown crystals were a mixture of hydroxyalkyl peroxides.

Hydroxyheptyl peroxide was decomposed by heating a sample in a test tube at 100° C. for one hour. When this decomposition was carried out in the presence of air, 0.230 moles of formic acid per mole of peroxide were obtained; however, in a nitrogen atmosphere only 0.016 moles were obtained. The decomposition of hydroxycyclohexyl peroxide under the same conditions occurred slowly, but formic acid was also obtained.

It has been proposed that the primary hydroperoxides formed during the autoxidation of fats are again attacked by oxygen to form a dihydroperoxide which rearranges to yield an ozonide. The latter produces hydroxyalkyl peroxides on hydrolysis which by oxidative thermal decomposition yield formic acid and other scission acids and aldehydes. Since only small amounts of scission products are required for rancidification, the proposed reactions need occur only to a limited extent to be significant.

120 pages. $1.50. Mic 56-705

THE PREPARATION AND REACTIONS OF 1-n-BUTYL-2,5-DIMETHYLPYRROLE-3,4-DICARBOXYLIC ACID CHLORIDE AND ANHYDRIDE

(Publication No. 14,960)

James A. Gallagher, Ph.D.
University of Missouri, 1955

Supervisor: Dr. Dorothy V. Nightingale

1-n-Butyl-2,5-dimethylpyrrole-3,4-dicarboxylic acid chloride and anhydride have been prepared.

Benzene, toluene, o-, m- and p-xylene were acylated with the acid chloride in the presence of aluminum chloride. With each of these hydrocarbons, the acid chloride reacted twice with the same aromatic nucleus to give quinone type compounds. When mesitylene was used for this reaction, two mesitylene nucleii were acylated giving a diketone. When the acid chloride was added to aluminum chloride in an inert solvent, there was no isomerization such as phthalyl chloride undergoes in the presence of aluminum chloride, and a quinone type compound was also obtained from this reaction. None of these reactions gave any indication that only one of the acid chloride groups reacted to give a keto acid.

Acylation of benzene with the anhydride also gave a quinone which was identical with that obtained from acylation of benzene with the acid chloride. Acylation of toluene with the anhydride gave two products, a quinone and a keto acid, the latter due to mono acylation of the toluene nucleus.

Analysis of these quinones with the Grignard machine gave some interesting results. If the excess

methylmagnesium iodide was decomposed before the reaction flask was heated in boiling water, only one carbonyl group was reacted. If the flask was heated before decomposing the excess Grignard reagent, two carbonyl groups and an active hydrogen were indicated. No explanation can be offered for the source of the active hydrogen.

Reactions of the anhydride with phenylmagnesium bromide, diphenylcadmium, phenyllithium, n-butyllithium and methyllithium were also studied. Phenylmagnesium bromide and diphenylcadmium gave the same product, a keto acid. Phenyllithium and methyllithium gave compounds analogous to the phthalids. No product could be isolated from the reaction of the anhydride with n-butyllithium.

The reaction of 1-n-butyl-2,5-dimethyl-3-benzoylpyrrole-4-carbonyl chloride with toluene in the presence of aluminum chloride gave a quinone which was identical with that obtained from the acylation of benzene with 1-n-butyl-2,5-dimethylpyrrole-3,4-dicarbonyl chloride.

94 pages. $1.18. Mic 56-706

CERTAIN STRUCTURAL FACTORS GOVERNING THE FORMATION OF THE I-STEROID SYSTEM

(Publication No. 13,693)

Stephen Gates, Ph.D.
Princeton University, 1954

The p-toluene sulfonate of 4-penten-2-ol (VIII) was prepared, and its solvolysis in methanol was observed with and without added acetate. The only products isolated were the normal ether (IXa) and acetate (IXb), whose identities were then shown by direct synthesis. No cyclic products could be found.

$\Delta^{1(9)}$-octalone-2 (XIVa) was prepared and converted to its enol benzoate (XVa) and p-nitrobenzoate (XVb). The enol benzoate was reduced with sodium borohydride to a mixture of alcohols. Attempts to determine their structure were unsuccessful.

10-methyl-$\Delta^{1(9)}$-octalone-2 (XIVb) was prepared and converted to its enol benzoate (XVc) and p-nitrobenzoate (XVd). Further attempts to prepare bicyclic homoallylic alcohols were not made.

3,5-cyclocholestanone-6 (XXI) was oxidized with hypobromite to 3,5-cyclocholestan-6//7-dicarboxylic acid (XXIIa). The infrared spectra of the acid (XXIIa) and its dimethyl ester (XXIIb) were taken, and features were observed which supported the previously assigned structure of the acid (XXIIa).

3-β-chlorocholestan-6//7-dicarboxylic acid (XXIII) was dehydrohalogenated with sodium alkoxide in alcohol. The infrared and ultraviolet spectra of the product and the method of preparation resulted in the acid being assigned the structure of Δ^{4}-cholesten-6//7-dicarboxylic acid (XXIVa).

The acid (XXIVa) was not the same as a 265° acid prepared in an earlier investigation. Efforts to duplicate the earlier work were unavailing. The infrared and ultraviolet spectra, and the physical properties of the 265° acid were judged to be incompatible with those of any simple dehydrohalogenation product of the chlorodiacid (XXIII).

An acid, m. p. 230-231°, prepared in the earlier investigation was shown to be 3-β-hydroxycholestan-6//7-dicarboxylic acid (XXVIIIa) by a comparison of the infrared spectrum of its dimethyl ester with that of a genuine specimen. Kinetic and experimental evidence that the lactone (XXVII) is the primary product of the dehydrohalogenation of the chloroacid (XXVI) is given, in opposition to assertion in the literature. 80 pages. $1.00. Mic 56-707

STUDIES ON LIGNIN: PART I: ISOLATION AND STRUCTURE OF ALKALINE OXIDATION PRODUCTS OF LIGNIN SULFONATES. PART II: ISOLATION AND STRUCTURE OF LOW MOLECULAR WEIGHT LIGNIN SULFONATES.

(Publication No. 15,701)

Douglas William Glennie, Ph.D.
University of Washington, 1955

The present investigations were directed towards the elucidation of lignin structure through an extension of studies of alkaline cleavage products of lignin sulfonates and also through studies of low molecular weight lignin sulfonates.

In prior experiments involving alkaline cupric oxide treatments of lignin sulfonates, several unknown substances detected in reaction mixtures were characterized by electrophoretic mobility and ultraviolet absorption spectra. One of these substances, apparently heretofore unrecognized as a cleavage product was isolated in low yield but in relatively pure form. This substance has now been identified as vanilloylformic acid.

Two methods for the synthesis of vanilloylformic acid were developed to supplement those previously described in the literature.

An investigation of the behavior of certain known degradation products under lignin sulfonate cleavage conditions led to the following conclusions: (1) vanilloylformic acid is one intermediate in the formation of vanillic acid and possibly vanillin, (2) acetovanillone and vanillic acid appear to be stable end products, (3) 3,3′-dimethoxy-4,4′-dihydroxychalcone appears to be cleaved readily to yield acetovanillone, vanillin and vanillic acid, (4) dehydrodivanillin appears to yield the intermediate bis-vanillin-vanillic acid compound, in addition to dehydrodivanillic acid.

It is suggested that vanilloylformic acid may derive from vanilloyl carbinol or guaiacylglycol structural units, either present in the lignin molecule or formed during reaction.

Electrophoretic mobilities and ultraviolet absorption spectra in buffered gel were measured for 3,3′-dimethoxy-4,4′-dihydroxychalcone, p-hydroxybenzaldehyde, vanillil, guaiacylglycolic, p-anisoylformic, p-hydroxybenzoylformic and protocatechuoylformic acid. Comparison of these characteristics with those for the several unknown phenolic degradation products of lignin sulfonates previously detected indicated that two of these products may be p-hydroxybenzaldehyde and protocatechuoylformic acid.

In accordance with certain results of lignin research previously reported it seems necessary to postulate the presence of units of structurally different types in lignin in order to account for the type of phenolic degradation products obtained.

Prior studies have established the polymeric character

of lignin sulfonates and the presence in certain whole lignin sulfonates of about five percent of lignin sulfonate monomers and dimers. A procedure has now been evolved for the separation of these components from the higher molecular weight components in about fifteen percent yield of the estimated theoretical yield.

Partial separation of individual lignin sulfonate components was achieved by Craig machine extraction followed by ion exchange resin chromatography. Components were further separated by repeated chromatography on Fluorisil and silica gel and in all, fifteen solid samples were isolated in this way. These were characterized by their crystal form, ultraviolet absorption spectra and absorptivities, column volume characteristics and infrared absorption spectra.

One definitely crystalline sample was found to be a monomeric sulfonate compound, $C_{10}H_{12.7}O_{1.08}(SO_3Ca/2)_{1.12}$, containing a phenolic hydroxyl and a methoxyl group. Comparison of the infrared absorption spectrum of this substance with that for calcium α-guaiacylpropylsulfonate and also β-guaiacylisopropylsulfonate indicated the similarity but nonidentity of the three substances. It is suggested that this unknown may be calcium γ-guaiacylallylsulfonate which may arise from sulfonation of coniferin or coniferyl alcohol or by simultaneous sulfonation and hydrolysis of similar structures in the lignin molecule.

From the infrared absorption spectra of lignin sulfonate fractions ranging in molecular weight from about 660 to 270,000 the lignin sulfonate polymer appears not to possess a unique end group which is detectable by this means. This suggests that the structural units comprising the polymer are linked in such a way as to preserve approximately constant the proportion of functional groups throughout the polymer molecule, independent of molecular weight.

The similarity in the infrared absorption spectra for isolated low molecular weight lignin sulfonate components with those for higher molecular weight lignin sulfonate fractions suggests that these components may be representative of the structural units in the lignin sulfonate polymer molecule. 278 pages. $3.48. Mic 56-708

DERIVATIVES OF STERICALLY-HINDERED KETONES

(Publication No. 15,794)

Frances Greer, Ph.D.
Vanderbilt University, 1955

Supervisor: Professor D. E. Pearson

It has long been believed that certain acetophenones and benzophenones are incapable of forming isolable derivatives through their carbonyl group because of the protective interference of surrounding groups of atoms. These neighboring groups were believed to function either by effectively blocking the approach of the reagent or by occupying sufficient space to preclude the existence of the intermediate complex or of the derivative itself. It was the purpose of the present investigation to submit this popular belief to test in the case of the reaction of hydroxylamine with the so-called "hindered" ketones.

The oximes of 2,4,6-trimethylacetophenone and 2,6-dimethyl-4-t-butylacetophenone were prepared by the direct reaction of hydroxylamine and the parent ketone. These oximes have never previously been prepared by direct methods.

Investigation of nine modifications for the preparation of difficultly-oximated ketones resulted in yields of the desired oxime ranging from one to forty per cent. It was shown that, of the methods tested, those utilizing essentially anhydrous conditions in weakly basic media resulted in the highest yields.

Semi-quantitative studies of the rate of the Beckmann rearrangement of 2,4,6-trimethylacetophenone oxime as compared to that of 2,6-dimethyl-4-t-butylacetophenone oxime revealed that the former rearrangement is at least ninety-four per cent complete in seventy-five minutes at 0° C. in concentrated sulfuric acid. The rearrangement of 2,6-dimethyl-4-t-butylacetophenone oxime is not complete under the same conditions in 180 minutes. The rate of rearrangement of 2,4,6-trimethylacetophenone oxime is the fastest yet observed for any oxime.

The oxime of 2,4,6-trimethylbenzophenone was prepared in approximately one per cent yield, but the oxime of 2,3,5,6-tetramethylbenzophenone was not obtained.

The tendency of oximes to form sodium salts is a characteristic reaction of this type of compound. The oxime of 2,4,6-trimethylacetophenone was found to be quite soluble in cold sodium hydroxide solutions varying from five to twenty per cent. On the other hand, 2,6-dimethyl-4-t-butylacetophenone oxime and 2,4,6-trimethylbenzophenone oxime were only slightly soluble in cold or hot sodium hydroxide solutions.

Attempts were made to prepare 2-t-butylacetophenone or its oxime by a method which utilizes the condensation of acetaldoxime with the diazonium salt of an aromatic amine. These attempts were unsuccessful, but the instability of the diazonium salt at temperatures much above -40° C., as well as its insolubility, are believed to be the major factors responsible for failure. Contributions have been made toward knowledge of the behavior of the unstable diazonium sulfate, hydrochloride, and hydrobromide of 2-t-butylaniline. 82 pages. $1.03. Mic 56-709

A STUDY OF THE FRIEDEL-CRAFTS ACYLATION AND SULFONYLATION REACTIONS (PARTS I AND II)

(Publication No. 14,407)

Frederick Richard Jensen, Ph.D.
Purdue University, 1955

Major Professor: Herbert C. Brown

In benzoyl chloride as solvent and using aluminum chloride as catalyst, the Friedel-Crafts acylation reaction follows second order kinetics, rate = k_2 ($C_6H_5COCl \cdot AlCl_3$) (ArH). An isotope effect of intermediate magnitude occurs in the Friedel-Crafts acylation of deuterium substituted aromatic hydrocarbons. The isomer distribution in the benzoylation of toluene is: 9.3% ortho, 1.45% meta, and 89.3% para; the reactivity ratio for the benzoylation of toluene and benzene is 110:1; these results are in excellent agreement with the generalization suggested by Brown and

Nelson for correlation of aromatic substitution data. The absolute rates of benzoylation of the monoalkyl- and polymethyl-benzenes were determined using nitrobenzene as solvent and aluminum chloride as catalyst. These values are not in good agreement with the values calculated from partial rate factors. The kinetics of the Friedel-Crafts acylation reaction were determined using $GaCl_3$, $SbCl_5$, $FeCl_3$, $SnCl_4$ and BCl_3 as catalysts, and the reactions using these catalysts follow different kinetic expressions. As determined from absolute rate constants, the relative order of decreasing effectiveness of a series of Friedel-Crafts acylation catalysts is; $SbCl_5$ - 1300, $FeCl_3$ - 570, $GaCl_3$ - 500, $AlCl_3$ - 1, $SnCl_4$ -1/350, BCl_3 - 1/1600 and $SbCl_3$ - negligible. The kinetics of the Friedel-Crafts acylation reaction were studied in a series of non-polar solvents, and the rate constants obtained depend on the initial concentrations. Although, the kinetics are not well understood, it is suggested that this reaction may be subject to general acid catalysis by Lewis acids.

Although considerable evidence has been accumulated, it is still not possible to decide with confidence between three possible mechanisms; (1) Transfer of the aluminum halide from the oxygen atom in the complex to the chlorine atom followed by displacement of the $AlCl_4^-$ ion by the aromatic hydrocarbon; (2) Transfer of the aluminum halide from the oxygen atom in the complex to the chlorine atom, ionization, attack of the RCO^+ ion on the aromatic, and decomposition of the σ-complex (required to be the slow step); (3) Displacement of the carbonyl bond by the aromatic compound to form an unstable intermediate, which loses hydrogen chloride to form the product of the reaction.

For non-reactive aromatic compounds, and in nitrobenzene as solvent, the Friedel-Crafts sulfonylation reaction follows third order kinetics, rate = $k_3(AlCl_3)(C_6H_5SO_2Cl)(ArH)$; and for reactive compounds, rate = $k_2(AlCl_3)(C_6H_5SO_2Cl)$. In benzenesulfonyl chloride as solvent, for the reaction with chlorobenzene,

$$\text{rate} = k_{3/2}\,(C_6H_5SO_2Cl\cdot AlCl_3)^{1/2}(C_6H_5Cl)\ ;$$

for the reaction with toluene, rate = $k_2(C_6H_5SO_2Cl\cdot AlCl_3)(C_6H_5CH_3)$; for the reaction with benzene, the kinetic order is ill-defined. These results indicate that the reaction with non-reactive compounds proceeds by an ionic mechanism, and by a displacement mechanism with reactive compounds. The isomer distribution for the sulfonylation of toluene is: 28.4% ortho, 8.7% meta and 62.9% para; the

$$k_{toluene}/k_{benzene}$$

ratio is 8.0 ± 1; and these results are in good agreement with the generalization suggested by Brown and Nelson for the correlation of aromatic substitution data. A small isotope effect occurs in the sulfonylation of p-deuterotoluene. Gallium trichloride is a far more active catalyst for the Friedel-Crafts sulfonylation reaction than aluminum chloride, while stannic chloride is a far less active catalyst.

453 pages. $5.66. Mic 56-710

THE SYNTHESIS AND RESOLUTION OF PHENANTHRO[3,4-c]PHENANTHRENE

(Publication No. 15,854)

Daniel Lednicer, Ph.D.
The Ohio State University, 1955

The synthesis of phenanthro[3,4-c]phenanthrene is described.

1,2,3,4-Tetrahydro-4(1-naphthyl)-oxo-3-phenanthreneacetic acid was prepared by a method analogous to that used in the synthesis of 1,12-dimethylbenzo[c]phenanthrene, though an improved bis-homologation procedure was employed.

Attempts to proceed to the aromatic hydrocarbon, from the diketone obtained by ring closure of the keto-acid, were unsuccessful.

Reduction of the ketone group of the above acid to a methylene followed by cyclization yielded a monoketone. This was successfully taken to the final product in a number of steps.

On Wolf-Kishner reduction, the monoketone and diketone afforded isomeric hydroaromatic hydrocarbons. Evidence for assigning the naphtho-1′,8′,3,4,5-cyclohepta-[1,2-c]phenanthrene ring structure to the reduction product of the diketone is discussed.

The resolution of the aromatic hydrocarbon into its optically active antipodes is recorded.

66 pages. $1.00. Mic 56-711

THE SYNTHESES AND ELECTROPHILIC REACTIONS OF THE RING-ACETYLSTYRENES

(Publication No. 14,961)

Leonard Levine, Ph.D.
University of Missouri, 1955

Supervisor: Wesley J. Dale

Meta-acetylstyrene, which has not been reported previously in the literature, was prepared by reaction of m-cyanostyrene with methylmagnesium iodide. A new, convenient and superior preparation of p-acetylstyrene was devised which involves the preparation and pyrolysis of beta-(p-acetylphenyl)-ethyl acetate.

The electronic character of the double bond in the o-, m-, and p-acetylstyrene was investigated by reaction of the isomeric acetylstyrenes with the following four types of typically nucleophilic reagents: amines, enolates, Grignard reagents, and Reformatsky reagents.

Secondary amines with small steric requirements around the nitrogen atom, such as piperidine and pyrollidine, were observed to add readily to the vinyl group of o- and p-acetylstyrene. n-Butylamine reacted with o- and p-acetylstyrene to give the corresponding Schiff bases.

Metal enolates were observed to add readily to p-acetylstyrene, but failed to combine with o-acetylstyrene.

The addition to o- and p-acetylstyrene of Grignard reagents and of the Reformatsky reagent employing ethyl bromoacetate yielded only products resulting from addition to the carbonyl groups. No products corresponding to

conjugate addition were isolated with the organometallic reagents used in these experiments.

Under the conditions of the above reactions, no additions of enolates or amines could be effected to m-acetylstyrene.

The above experiments show that the acetyl group, when situated ortho or para to the vinyl group in the acetylstyrenes, converts the double bond from a nucleophilic group to an electrophilic one. The -T effect of the acetyl group is therefore transmitted, in o- and p-acetylstyrene, through the ring and the double bond in sufficient strength to cause reaction with typical nucleophilic reagents. The spectral data are in harmony with these conclusions.

61 pages. $1.00. Mic 56-712

CARBOHYDRATES OF THE COFFEE BEAN

(Publication No. 15,880)

Richard Allan Plunkett, Ph.D.
The Ohio State University, 1955

The general objective of the work was to make a survey of the nature of the carbohydrates in the green coffee bean by modern methods and to characterize such non-carbohydrate constituents as were incidentally encountered.

Ground green Santos coffee beans were successively extracted with 80/20 :: ethanol/water, 2/1 :: benzene/ethanol, water, 0.5 per cent aqueous ammonium oxalate (pectin removal), acidified aqueous sodium chlorite (holocellulose preparation), and 10 per cent aqueous potassium hydroxide (hemicellulose removal).

The 80/20 :: ethanol/water extract of the green coffee bean was fractionated on fuller's earth clay, Florex XXX-Celite (5 :: 1 by weight) with graded aqueous ethanol developers. The 95/5 :: ethanol/water fraction gave sucrose and caffeine by definitive isolation; chlorogenic acid, isochlorogenic acid, caffeic acid, and trigonelline were identified by paper and electrochromatography. Paper chromatography was effected by the descending method with 40/19/11 :: 1-butanol/water/ethanol as a developer and 1-2 per cent p-anisidine in water-saturated 1-butanol as a spray reagent (for sugars). Paper electrochromatography was done in borate buffer at pH 10, 800 volts, and 10-15 milliamperes. The same spray reagent was used as in the paper chromatography. The 80/20 :: ethanol/water fraction gave chlorogenic acid by definitive isolation; isochlorogenic acid or caffeic acid or both, trigonelline, and a trace of sucrose were identified by paper and electrochromatography. The following amino acids were identified in the 80/20 :: ethanol/water fraction by paper chromatography: glycine, α-alanine, γ-aminobutyric acid, proline, valine, leucine (or isoleucine), and tyrosine. The amino acids were chromatographed by the two-dimensional descending method with 80/20 :: phenol/water and water-saturated collidine as developers and 0.2 per cent ninhydrin in water-saturated 1-butanol as a spray reagent. Trigonelline and the following amino acids: aspartic acid, glutamic acid, serine, asparagine, α-alanine, and γ-aminobutyric acid were identified in the 50/50 :: ethanol/water fraction.

An 80/20 :: ethanol/water extract of roast coffee was also fractionated on clay. By paper chromatography the 95/5 :: ethanol/water fraction contained sucrose, glucose, fructose, chlorogenic acid, isochlorogenic acid or caffeic acid or both, and caffeine. The 80/20 :: ethanol/water fraction contained chlorogenic acid, isochlorogenic acid or caffeic acid or both, and trigonelline. Significantly, there was no trace of free amino acids in the roast coffee.

Examination of paper and electrochromatograms under ultraviolet light served to locate chlorogenic acid and isochlorogenic acid (blue-white fluorescence) and trigonelline (rust-colored fluorescence).

Techniques were developed for the identification of caffeine on paper chromatograms and clay columns. The paper or electrochromatogram containing caffeine is dried and dipped in an acidified ether solution of pyrene (0.01 per cent, wt./vol.). Under ultraviolet light the caffeine appears as a spot of quenched fluorescence on a bright yellow-white background. To detect caffeine on clay, the column is streaked with slightly acidified bromothymol blue indicator; the caffeine zone appears as a blue section on the yellow streak.

On hydrolysis, the water-soluble polysaccharide material yielded (as determined by paper chromatography) galactose, arabinose, and rhamnose (or apiose); the pectin fraction yielded galactose, arabinose, mannose, and rhamnose (or apiose); the material soluble in 10 per cent potassium hydroxide (mainly hemicellulose-B type) yielded galactose, arabinose, xylose, and mannose.

The 10 per cent potassium hydroxide-insoluble residue was acetylated with acetic acid-trifluoroacetic anhydride to give about equal amounts of a chloroform-soluble polysaccharide acetate and a chloroform-insoluble polysaccharide acetate. On deacetylation and hydrolysis, the chloroform-soluble acetate yielded (as determined by electrochromatography) galactose, mannose, arabinose, and a trace of glucose; the chloroform-insoluble acetate yielded mannose, glucose, and a trace of galactose.

153 pages. $1.91. Mic 56-713

A STUDY OF THE BUTTRESSING EFFECT IN SOME REACTIONS OF DIALKYLPYRIDINES

(Publication No. 14,422)

Harold Podall, Ph.D.
Purdue University, 1955

Major Professor: Herbert C. Brown

The buttressing effect in some reactions of 2-methyl-3-alkylpyridines was studied. In order to evaluate the buttressing effect the reactivity of the 2-methyl-3-alkylpyridines were compared with those of the isomeric 2-methyl-5-alkylpyridines.

The pK_a values in water, heats of reaction with methanesulfonic acid and with boron trifluoride tetrahydropyran in nitrobenzene, and the rates of reaction with methyl-, ethyl-, and isopropyl iodide in nitrobenzene at three temperatures of pyridine, 2-picoline, 2,3-lutidine, 2,4-lutidine, 2,5-lutidine, 2,6-lutidine and of 2,4,6-collidine were determined.

The pK_a values of the lutidines, except 2,3-lutidine, agreed with the additive values. The pK_a of 2,3-lutidine was 0.11 $\pm$ .02 pK units greater than that of 2,5-lutidine. This was attributed as due to the presence of a field effect

in 2,3-lutidine, which causes it to be slightly more basic towards a proton than 2,5-lutidine. The heats of reaction with methanesulfonic acid paralleled the pK_a results, thus confirming the above conclusions.

The heats of reaction with boron trifluoride of the lutidines, except 2,3-lutidine, and of 2,4,6-collidine were in good agreement with the additive values, providing molecules of similar steric requirements were compared. The heat of reaction of 2,3-lutidine with boron trifluoride tetrahydropyran was 0.7 ± .1 kcal/mol smaller than that of 2,5-lutidine, despite the slightly greater basicity of 2,3-lutidine. This surprising result was attributed as due to the presence of a buttressing effect in 2,3-lutidine, which becomes important in reactions of significant steric requirements. Quite similar results were obtained with the log (rate constants) and heats of activation for the reactions with the three alkyl iodides. Additivity was again observed for reactions of constant steric requirements. The rate of reaction of 2,3-lutidine with methyl iodide at 25° was approximately one-half of that for 2,5-lutidine; the reaction with 2,3-lutidine having a heat of activation 0.5 ± .2 kcal/mol greater than that for 2,5-lutidine. This was again attributed as due to a buttressing effect in 2,3-lutidine. However, it was surprisingly found that the reactivity of 2,3-lutidine relative to 2,5-lutidine decreased only very slightly in going from methyl-, to ethyl-, to isopropyl iodide.

2,6-Lutidine and 2,4,6-collidine were found not to fit the linear strain-energy relationship for the reactions with boron trifluoride and with methyl iodide, previously found for the 2-alkylpyridines. This was attributed as due to (1) a difference in the geometry between the methyl and boron trifluoride groups and (2) to a different type of steric interaction between the α,α'-dimethyl groups and the nitrogen bonded group than in the case of a single α-alkyl group.

The reaction between 3-alkylpyridines and methyllithium was studied in order to synthesize 2-methyl-3-alkyl-and 2-methyl-5-alkylpyridines, alkyl = methyl-, ethyl-, isopropyl-, and t-butyl. It was surprisingly found that the reaction produced almost exclusively 2,3-lutidine from 3-picoline, and 2-methyl-3-ethylpyridine from 3-ethylpyridine. In the case of 3-isopropylpyridine, both isomers were produced, the 2,3-isomer still being in excess. With 3-t-butylpyridine, only the 2,5-isomer resulted. A procedure was developed for separating the 2,3- from the close boiling 2,5-isomer via differential solubility of their hydrochlorides and picrates. In this manner, 2-methyl-5-isopropyl-, 2-methyl-3-isopropyl-, 2,6-dimethyl-3-isopropyl-, and 2-methyl-5-t-butylpyridine were synthesized in a state of high purity. The latter three compounds were new compounds, and were characterized mainly from their infrared spectra (as well as from their analytical results).

The heats of reaction with boron trifluoride tetrahydropyran of the 2-methyl-5-alkylpyridines were additive (alkyl = methyl-, ethyl-, isopropyl-, and t-butyl). The heats of reaction of the 2-methyl-3-alkylpyridines decreased in going from alkyl = methyl-, to ethyl-, to isopropyl; the buttressing strain in the adduct being estimated at 0.7, 0.8, and 1.1 kcal/mol, respectively. The increase in buttressing strain appears to parallel the increase in F-strain for the corresponding 2-alkylpyridines. The buttressing strain in 2-methyl-3-t-butylpyridine boron trifluoride was thereby predicted as being about 3 kcal/mol.

359 pages. $4.49. Mic 56-714

A STUDY OF SOME ALIPHATIC ALDEHYDES AND THE BENZOIN CONDENSATION

(Publication No. 15,913)

Thomas Glenn Roberts, Ph.D.
University of South Carolina, 1956

In a continuation of the research reported in his M. S. Thesis, the author has shown that pivalaldehyde undergoes the crossed benzoin condensation with benzaldehyde to form the isomeric unsymmetrical benzoins, phenylpivalylcarbinol and benzoyl-tert-butylcarbinol. The identities of the two products were conclusively demonstrated, and the relative proportions in which the isomers were produced were determined by three independent methods. That the two benzoins were not necessarily independently formed was demonstrated by the isomerization of either pure isomer under the conditions of the benzoin condensation to a mixture having the same composition as that of the mixture produced by crossed condensation. Although a few other reports of the isolation of both possible isomers as products resulting from the crossed benzoin condensation have been made, the present report appears to be the first completely substantiated instance of such a result.

The formation of the mixed benzoins from pivalaldehyde and benzaldehyde fails to provide conclusive evidence as to the cause of the failure of pivalaldehyde to form a symmetrical benzoin. As a possible means of securing information as to the relative importance of steric and electrical effects, a number of aliphatic aldehydes were subjected to the conditions of the benzoin condensation and the reaction products examined for evidence of benzoin formation.

As expected, alpha-chlorisobutyraldehyde, prepared by the chlorination of isobutyraldehyde in n-pentane, underwent dehydrohalogenation in a solution of potassium cyanide. No evidence of benzoin formation was found. The observed result made meaningless an attempt to correlate a reduction in the electron-releasing effect present in pivalaldehyde with its possible effect on the ability of the chloroaldehyde to form a symmetrical benzoin.

The new aldehyde, 1-methylcyclobutanecarboxaldehyde, gave only unidentified products. None of the symmetrical benzoin which would be formed if benzoin condensation had occurred was detected. This aldehyde was synthesized by the reaction of dimethylformamide with 1-methylcyclobutylmagnesium chloride. An authentic sample of the symmetrical benzoin was prepared by the acyloin condensation of the ethyl ester of 1-methylcyclobutanecarboxylic acid.

The reaction of n-butyraldehyde with benzaldehyde gave an aldol-type product, alpha-ethylcinnamaldehyde. The mixed benzoin, phenylbutyrylcarbinol, one of the two possible isomers which would have been formed if crossed benzoin condensation had taken place, was not detected among the reaction products.

Pivalaldehyde failed to form an unsymmetrical benzoin with 4-dimethylaminobenzaldehyde, a result consistent with the observation that apparently at least one of the aldehydes taking part in a crossed benzoin condensation must be capable of forming a symmetrical benzoin.

tert-Butylglyoxal was found to give a product whose physical and chemical properties and infrared spectrum were consistent with those expected of pivalylformoin. The small amount available and its decomposition prevented complete characterization.

The formation of an unsymmetrical benzoin from pivalaldehyde and benzaldehyde is unique because it is the first case of the participation in the benzoin condensation reaction of an aldehyde having no pi-electrons on the alpha-carbon atom.

The negative results obtained in most of this research provide no evidence whereby definite roles may be assigned to steric and electrical factors in regulating the ability of aliphatic aldehydes to undergo the benzoin condensation. 72 pages. $1.00. Mic 56-715

INVESTIGATION ON THE CHEMICAL BEHAVIOR OF CERTAIN NITROPYRIDOTETRAZOLES AND THE CORRESPONDING DINITROSOPYRIDINE MOLECULES

(Publication No. 15,687)

William Schoen, Ph.D.
Tulane University, 1956

Coumalic acid obtained from malic acid and concentrated sulfuric acid was esterified with methanol. The action of aqueous ammonia at room temperature followed by hydrolysis with hot aqueous sodium hydroxide was used to convert the ester to 6-hydroxynicotinic acid. Upon nitration with fuming nitric acid 5-nitro-6-hydroxynicotinic acid was then obtained.

The methyl ester of 5-nitro-6-chloronicotinic acid was obtained by treating 5-nitro-6-hydroxynicotinic acid with a phosphorous pentachloride-phosphorous oxychloride mixture followed by esterifying with methanol. Transformation into 6-carbomethoxy-8-nitropyridotetrazole was accomplished by the action of sodium azide. Pyrolysis of the tetrazole resulted in the formation of ψ-2,3-dinitroso-5-carbomethoxypyridine (pseudo-2,3-dinitroso-5-carbomethoxypyridine).

Treatment of 5-nitro-6-hydroxynicotinic acid with a phosphorous pentachloride-phosphorous oxychloride mixture followed by hydrolysis yielded 5-nitro-6-chloronicotinic acid. The latter was converted to 6-carboxy-8-nitropyridotetrazole by the action of sodium azide. Isolation of ψ-2,3-dinitroso-5-carboxypyridine resulted from thermal decomposition of the tetrazole.

In another sequence, 2-amino-3-nitro-5-methylpyridine was prepared by nitration of 2-amino-5-methylpyridine. Diazotization followed by hydrolysis allowed the formation of 2-hydroxy-3-nitro-5-methylpyridine. The latter was converted into 2-chloro-3-nitro-5-methylpyridine which, in turn, reacted with sodium azide to complete the synthesis of 6-methyl-8-nitropyridotetrazole. As expected, pyrolysis of the tetrazole afforded good yields of ψ-2,3-dinitroso-5-methylpyridine.

Treatment of ψ-2,3-dinitroso-5-methylpyridine with alkaline hydroxylamine brought about both reduction and amination with the formation of 5-methyl-6-amino-2,3-pyridoquinonedioxime. Direct amination of 2-amino-3-nitropyridine and 2-amino-3-nitro-5-methylpyridine with alkaline hydroxylamine was demonstrated; whereas similar experiments upon pyridine derivatives which did not contain a nitro group were unsuccessful.

A review of the literature revealed that each of the structures previously assigned to o-dinitroso aromatic compounds failed in some important respect to adequately describe their properties. The quinone dioxime peroxide structure suggested by Forster and Fierz in 1907, indicated a peroxide linkage between two oxygen atoms, but the o-dinitroso compounds do not exhibit peroxide properties. In 1912 Green and Rowe stressed the quinonoid nature of the o-dinitroso compounds and advocated a benzfurazane oxide (benzfuroxane) structure. A quinonoid furoxane structure, however, cannot account for the nonexistence of unsymmetrical derivatives. This deficiency was later encountered by Green and Rowe, with the result that they rejected their own quinonoid furoxane representation in favor of a benzenoid epoxy type structure. The latter, however, does not adequately explain the quinonoid properties of the o-dinitroso aromatic compounds.

The assignment of a hybrid structure and the change in nomenclature from "furoxanes" to pseudo-o-dinitroso compounds, is in better agreement with the known chemical and physical properties of the o-dinitroso aromatic compounds. In accord with this representation, there can be only one monosubstituted o-dinitroso aromatic derivative. The nonexistence of hydroxy and primary amino derivatives is adequately explained. The stability of the nitroso group toward oxidation is in agreement with the hybrid structure. The formulation expressed in ψ-o-dinitroso aromatic compounds is analagous to that for dimeric nitroso compounds, whose correct structure was established by reduction and x-ray crystallography. The pseudo formulation is also in agreement with the nonexistence of 1,2,4,5-tetranitrosobenzene and correctly predicts the stability of ψ-hexanitrosobenzene. The absence of a blue-green color in the aromatic o-dinitroso compounds further confirms the pseudo structure and the concept that that structure containing a nitroso group attached by a single bond to the nucleus is a minor contributor to the resonance system. Further support for the hybrid structure lies in infrared spectral analyses and in the high dipole moment of ψ-o-dinitrosobenzene.

Experimental evidence was obtained which added further weight to the idea of a hybrid structure, particularly in the pyridine series. In the preparation of 5-carboxy-, 5-carbomethoxy-, and 5-methyl- derivatives of ψ-2,3-dinitrosopyridine, no two isomers were ever isolated corresponding to a pyridofuroxane structure. Furthermore all of the o-dinitrosopyridine compounds were yellow; no blue-green compound was ever isolated which would indicate a nitroso group attached to carbon through a single bond. Infrared data on these compounds also strengthened the idea of a hybrid structure for the ψ-o-dinitroso-pyridine compounds. 93 pages. $1.16. Mic 56-716

A STUDY OF 2,4,6,7-TETRACHLOROPTERIDINE

(Publication No. 15,267)

William Reese Sherman, Ph.D.
University of Illinois, 1955

INTRODUCTION

The name "pteridine" has been given to the ring-system 1,3,5,8-tetraazanapthalene. Ring Index nomenclature describes the nucleus as pyrimido(4,5-b)pyrazine. The occurrence of the pteridine nucleus in many natural products

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has created much interest in the chemistry of pteridines and pteridine-derivatives. The purpose of this research was to investigate the chemistry of simple pteridines and to devise syntheses of pteridines and of heterocyclic systems containing the pteridine nucleus. 2,4,6,7-Tetrachloropteridine was selected as the principle starting material because of its high reactivity with many reagents. Many of the syntheses were designed to provide compounds with potential activity as antagonists of the vitamin pteroylglutamic acid (folic acid). In this regard many of the products were submitted for pharmacological testing.

DISCUSSION

Improvements which facilitated the large scale preparation of the following previously known compounds were developed: 2,4-dihydroxy-5,6-diaminopyrimidine, 2,4,6,7-tetrahydroxypteridine and 2,4,6,7-tetrachloropteridine. During the preparation of 2,4,6,7-tetrahydroxypteridine, two by-products were encountered under two different conditions of product-isolation. The by-products were identified as (a) the known "bisalloxazine" (2,4,5,7-tetrahydroxypyrimido[5,4-g]pteridine) and (b) N,N'[5,5'-bis(2,4-dihydroxy-6-aminopyrimidyl)]oxalamide.

2,4,6,7-Tetrachloropteridine was reduced by lithium aluminum hydride to 2,4-dichloro-5,6,7,8-tetrahydropteridine. The structure of this substance was established (a) by an independent synthesis from 2,4-dichloropteridine, which determined the position of the chlorine atoms, and (b) by ultraviolet spectrum correlations which aided in locating the seat of the reduction in the molecule. The general utility of lithium aluminum hydride in the production of 5,6,7,8-tetrahydropteridines from pteridines was demonstrated by the reduction of pteridine and 2,4-dimethoxypteridine in addition to the above-mentioned 2,4-dichloropteridine and 2,4,6,7-tetrachloropteridine. 2,4-Diaminopteridine was reduced to a 2,4-diaminodihydropteridine by sodium borohydride in aqueous dimethylformamide.

The catalytic reduction of 2,4,6,7-tetrachloropteridine afforded 2,4-dichloro-6-hydroxy-7,8-dihydropteridine in high yield. The structure of the product was proven by an independent synthesis utilizing a sodium amalgam reduction of 2,4-dichloro-6,7-dihydroxypteridine.

2,4-Dichloro-5,6,7,8-tetrahydropteridine was catalytically reduced to 5,6,7,8-tetrahydropteridine. 2,4-Diamino- and 2,4-dimethoxy-5,6,7,8-tetrahydropteridine were oxidized under mild conditions to the corresponding pteridines while 5,6,7,8-tetrahydropteridine and 2,4-dichloro-5,6,7,8-tetrahydropteridine failed to be oxidized under these and under more strenuous conditions.

2,4,6,7-Tetraaminopteridine was prepared by the liquid ammonia amination of 2,4,6,7-tetrachloropteridine or 2,4-dichloro-6,7-diaminopteridine at 150°, and was isolated and characterized as its mono-hydrochloride salt.

Three members of the pyrazinopteridine ring-system were synthesized from tetraaminopteridine hydrochloride: 2,4-diaminopyrazino(2,3-g)pteridine, 2-amino-4,7,8-trihydroxypyrazino(2,3-g)pteridine and an analog of pteroylglutamic acid, N-(p-[(2,4-diaminopyrazino[2,3-g]pteridin-7-yl-methyl)-amino]-benzoyl)glutamic acid. The last compound was characterized to only a limited degree.

One member of each of two new ring-systems was prepared from tetraaminopteridine hydrochloride: 2,4-diaminoimidazolo(4,5-g)pteridine, which was characterized as a formyl derivative and 2,4-diamino-7,9-dihydroxypteridyl(6,7-g)pteridine. 187 pages. $2.34. Mic 56-717

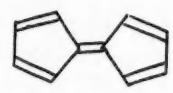
PART I: SYNTHESIS AND PROPERTIES OF TRIMETHYLAMMONIOCYCLOPENTADIENYLIDE. PART II: STUDIES RELATED TO THE SYNTHESIS OF FULVALENE.

(Publication No. 15,715)

William Walter Spooncer, Ph.D.
University of Washington, 1955

Part I of this thesis deals with the synthesis and properties of trimethylammoniocyclopentadienylide (I) and Part II with the attempted synthesis of fulvalene (II).

I



II

The ylide (I) has been synthesized in good yields by Hofmann elimination of trans-1,2-bis-(trimethylammonio)-3-cyclopentene diiodide, a precursor readily available from cyclopentadiene via cis-1,3-dibromocyclopentene, and trans-1,2-bis-(dimethylamino)-3-cyclopentene. The ylide represents the first known example of a stabilized cyclopentadienyl carbanion amenable to a study of aromatic properties. The ylide was found to be a weak base, in contrast to most ylides, the cause of which has been attributed to not only the positive inductive effect of the nitrogen entity, but also to a delocalization of π-electrons in the five-membered cyclic system. This latter phenomenon has also been borne out by an estimation of the resonance energy in I, about 36 kcal/mole, which adds validity to current theories regarding aromatic properties in the cyclopentadienyl systems. In addition to the anionic character of I, chemical evidence has been obtained which suggests that the ylide undergoes a one electron loss to a radical. In contrast to most ylides, derivatives of I were very difficult to prepare. Preliminary investigations suggest that the ylide might undergo aromatic substitution reactions.

Part II describes attempts directed toward the synthesis of fulvalene (II), the ten-carbon isomer of the aromatic compounds, azulene and naphthalene. Two essentially different reaction paths were investigated. The first was an attempt to couple two cyclopentadienyl rings either to dihydrofulvalene or to fulvalene directly. Thus, thermal decomposition of trimethylammoniocyclopentadienylide gave, instead of fulvalene, probably a mixture of azafulvenes. Reaction of cyclopentadienyl magnesium bromide with silver bromide resulted in formation of a very reactive compound whose properties suggest that coupling has taken place. Attempts to isolate or characterize this compound resulted in explosive peroxide formation and polymerization.

The second approach represented an attempt to synthesize fulvalene by degradation of substituted bicyclopentyl systems. In addition, preliminary investigations were conducted on the chemistry of the bicyclopentyl ring system itself. Vapor-phase dehydrogenation of 1,1'-bicyclopentene, bicyclopentylidene and 3,3'-bicyclopentene has shown the ring system to be stable under these conditions as evidenced by their recovery, rearrangement and partial dehydrogenation. The products which resulted from complete dehydrogenation were azulene and naphthalene. Dehydrobromination of 2,2',5,5'-tetrabromobicyclopentylidene, for which a synthetic route was evolved via bicyclopentylidene,

has shown that under a variety of conditions, a common reaction product, believed to be a bromo-substituted fulvene, was obtained. The purification of tetramethylenefulvene has been accomplished and preliminary investigations indicate this to be a potential precursor to fulvalene. Synthetic routes have been explored to obtain its isomer, 3-bicyclopenteneylidene, via degradative procedures of substituted bicyclopentyl systems for which new synthetic routes have been evolved. The triene was not obtained in pure form but evidence for its existence has been presented. The key intermediates, 2-cyclopentylidenecyclopentanol, 1,1′-bicyclopentene, 2,2′-dibromobicyclopentylidene, and 2,2′-bis-(dimethylamino)-bicyclopentylidene have been prepared, characterized and studied chemically. Correlations between physical and chemical properties have been made and new avenues for the preparation of fulvalene have been opened.

270 pages. $3.38. Mic 56-718

DERIVATIVES OF CHONDROITINSULFURIC ACID

(Publication No. 15,892)

Charles Gene Summers, Ph.D.
The Ohio State University, 1955

Heparin, a mucopolysaccharide, possesses the unique physiological property of preventing the clotting of blood in the human system. Evidence has been presented which indicated that the presence of sulfamic acid groups, along with O-sulfate groups, was a very important factor in the anticoagulant activity of this carbohydrate polymer. The purpose of the investigation was the preparation of a synthetic heparin-like anticoagulant possessing sulfamic acid and O-sulfate groups from chondroitinsulfate, a mucopolysaccharide, so as to verify the importance of the sulfamic acid group in the anticoagulant activity of these materials. The synthesis of the material required the preparation of pure chondroitinsulfate, of N-deacetylated chondroitinsulfate, and of N-deacetylated and sulfated chondroitinsulfuric acid.

Another purpose of the investigation was the euclidation of some of the details of the structure of chondroitinsulfuric acid by means of the synthesis of suitable derivatives. The final purpose of the investigation was the study of the chemistry of the sulfamate group occurring in the materials studied and suitable model compounds. This necessitated a study of the infrared spectral characteristics of these sulfamic acid derivatives for correlation of structural similarities.

A chromatographic procedure has been developed for the practical purification of crude chondroitinsulfuric acid. The purified sodium salt of this material was converted to the sodium acid and calcium salts, and these were characterized.

A study has been made of the various methods of N-deacetylating sodium chondroitinsulfate without greatly degrading the polymer. This material has been partially N-deacetylated by means of concentrated sodium hydroxide, under specified conditions, to yield a product which has been shown to have an acetyl content of approximately 0.6 groups per disaccharide unit. Preliminary study has been made of a procedure employing amide exchange for the deacetylation of this material.

Partially N-deacetylated sodium chondroitinsulfate, prepared by the strong alkali procedure, has been sulfated by means of chlorosulfonic acid in pyridine to yield a product containing approximately 3.5 sulfate groups per disaccharide unit and no free amino group. This material was found to possess an anticoagulant activity of approximately 50 per cent of that of heparin (in vitro) and of approximately the same in vivo toxicity of the latter. The homogeneous sulfation, by means of chlorosulfonic acid and pyridine in formamide solvent, of partially N-deacetylated chondroitinsulfate yielded a product which contained approximately 3.4 sulfate groups and 0.6 acetyl groups per disaccharide unit. This material was found to have an in vitro anticoagulant activity comparable with that of the material from the heterogeneous procedure. It contained no free amino group, was obtained in higher yield, and was less degraded than the former product. Sodium chondroitinsulfate was sulfated by the pyridine-chlorosulfonic acid procedure, and the resulting product was found to have a very low anticoagulant activity (in vitro).

Sodium chondroitinsulfate has been acetylated by means of acetic anhydride and pyridine in formamide solvent to yield an almost completely acetylated, but not desulfated, product. This material has been characterized.

The crystalline disodium salt of the trihydrate of 2-sulfamino ethylsulfuric acid has been prepared by the sulfation of ethanolamine with stabilized sulfur trioxide in pyridine. This compound has been characterized.

A study has been made of the infrared spectral characteristics of the various chondroitinsulfate derivatives, heparin and model sulfamate compounds, and the absorption band of the sulfamate group has been tentatively assigned as occurring at 1000 $cm.^{-1}$ in the infrared region.

Evidence has been presented which tends to indicate that the anticoagulant activity of essentially undegraded N-deacetylated and sulfated chondroitinsulfuric acid is dependent upon the degree of N-deacetylation prior to sulfation.

205 pages. $2.56. Mic 56-719

THE POSITION OF FREE HYDROXYL GROUPS IN ACETONE-SOLUBLE CELLULOSE ACETATE

(Publication No. 15,893)

Stanley George Sunderwirth, Ph.D.
The Ohio State University, 1955

The purpose of the investigation was to locate the position of the free hydroxyl groups in acetone-soluble cellulose acetate.

Cellulose acetate containing 2.27 acetate groups per anhydroglucose unit was tosylated with p-toluenesulfonyl chloride in pyridine. This tosylated cellulose acetate was then reacted with an excess of pyrrolidine to remove the acetyl groups and to replace the tosyl groups by pyrrolidino groups. With pyrrolidine, the removal of acetyl groups and replacement of tosyl groups was quantitative. The pyrrolidino groups were then considered to be in the positions occupied by the free hydroxyl groups in the original cellulose acetate.

Hydrolysis of the pyrrolidino cellulose, followed by chromatographic separation on Dowex 50, yielded three nitrogen-containing sugars. Organic microanalysis and periodate cleavage experiments indicated that these three

sugars were: 2-deoxy-2-pyrrolidino-D-mannose hydrochloride; 3-deoxy-3-pyrrolidino-D-allose hydrochloride; and 6-deoxy-6-pyrrolidino-D-glucose hydrochloride.

The isolation and identification of these nitrogen-containing sugars was considered to be good evidence that the free hydroxyl groups in acetone-soluble cellulose acetate are distributed in a random manner among the two, three, and six positions of the anhydroglucose unit. The available data indicate that the number of free hydroxyl groups in the three position is greater than that in the two position, which in turn is greater than that in the six position. 83 pages. $1.04. Mic 56-720

THE MOLECULAR STRUCTURE OF SOME ORGANIC FLUORIDES BY THE ELECTRON DIFFRACTION METHOD

(Publication No. 15,413)

James Allan Young, Ph.D.
Purdue University, 1949

Major Professor: R. L. Livingston

The structure of three organic compounds containing fluorine have been investigated by the electron diffraction method. The compounds studied were 1,2,4,5--tetrafluorobenzene, tetrafluoroethylene and perfluorodimethylether. The objective in this work was to ascertain the influence of fluorine substitution upon the structure of these compounds.

The electron diffraction apparatus built by Professor H. J. Yearian of the Purdue Physics Department was used to obtain the diffraction photographs of the fluorine compounds. The experimental technique and the general procedure followed in this work is substantially the same as that used by Buck and Livingston in their previous electron diffraction study of the structure of C_3F_6. (1)

The sample of 1,2,4,5--tetrafluorobenzene was provided by Dr. G. C. Finger of the State Geological Survey, Urbana, Illinois. Electron diffraction maxima on the photographs of this sample were measurable to an s value of twenty-six. The radial distribution curve calculated by the International Business Machine Tabulator utilizing a set of punched cards is given in Figure 1. The positions of the peaks appearing on this curve are 1.34, 2.35, 2.72, 3,59, 4.07, 4.65 and 5.30 Å. These values cannot all be assigned to particular distances in the molecule in order to yield a unique structure. The results of the radial distribution curve can be utilized, therefore, only for guidance in selecting average values for the parameters in the various models.

The parameters for models from which theoretical intensity curves were calculated are given in Table 2. For all models, except two, the molecule was assumed to belong to the $\underline{D}_{2h}$ point group. Of these the best correlation with the visual curve was found for curves of those models with an F-C-F angle of 120°. Of the seven models with this angle, only the curves for two could be eliminated qualitatively. These corresponded to the models in which the C-F distance was assumed to be 1.24 and 1.48 Å. The other five models with the C-F distance varying from 1.28 Å to 1.44 Å in intervals of 0.04 Å, gave qualitatively acceptable curves. These curves are given in Figure 1. The experimental values of the distances in the molecule as obtained from the s_a/s_o ratios are listed in Table 3. Since the C=C bond distance varies from 1.33 to 1.39 Å and the C-F distance from 1.31 to 1.41 Å, it is apparent that no definite statement can be made concerning the influence of the fluorines upon the size of the benzene ring. The only distances in the molecule that can be determined to the desired precision are two non-bonded distances from which the structure of the molecule cannot be deduced.

The second compound studied was tetrafluoroethylene. For this compound the particular objectives were to determine if the substitution of fluorine for hydrogen would cause a decrease in the length of a double bond as it does a single bond, and to determine if the C-F distance in this compound would be shorter than in saturated aliphatic fluorides containing but one fluorine atom on a single carbon atom.

The sample of tetrafluoroethylene was obtained from the Du Pont Company by Dr. E. F. Hitch. Features on the diffraction photographs of this compound were measurable to an s value of thirty. The two strongest peaks of the radial distribution curve for this compound occur at 1.31 Å and 2.26 Å. Both of the peaks are the results of the combination of two unresolved peaks corresponding to two different distances. The value of the first peak is of interest since it is due to the bonded C-F and bonded C=C distances and indicates that one of these distances is less than 1.31 Å.

A total of twenty-six intensity curves were calculated from rigid planar models. The parameters of these models are given in Table 6. The curves that can best be correlated with the experimental curve correspond to the five curves reproduced in Figure 2 for models F, L, M, S, and T. The experimentally determined values of the three parameters required to fix the structure of the compound are (1) C=C = 1.27 ± 0.04 Å, (2) C-F = 1.33 ± 0.02 Å and (3) F-C-F = 110 ± 2°.

Since the carbon to carbon bond distance in ethylene has been given the value 1.34 ± 0.02 Å (2), it is evident that the substitution of fluorine for hydrogen does result in a decrease in the length of the double bond. The C-F distance in this compound is comparable to the value of this distance generally found in saturated aliphatic compounds containing more than one fluorine on the same carbon atom.

The third compound studied was perfluorodimethylether. The objective was to determine the effect of the six fluorine atoms upon the C-O-C angle and the C-O bond distance. The sample of this compound was obtained from Dr. Pearlson of the Minnesota Mining and Manufacturing Company. The features on the electron diffraction photographs were measurable to a q value equal to ninety-four. This would correspond to an s value of thirty.

The radial distribution curve was obtained by the I.B.M. method and is reproduced in Figure 3. The one strong maxima of this curve occurs at 2.15 Å. This corresponds to a combination of the shortest F-F distances in the molecule and the F-O distances. The only other maxima in the curve that can be given any weight is the first at 1.31 Å, which corresponds to the C-F bond distance.

In order to fix the structure of perfluorodimethylether it is necessary to give the values of five parameters: (1) the C-O bond distance, (2) the C-F bond distance, (3) the C-O-C angle, (4) the F-C-F angle and (5) the orientation of one CF_3 group with respect to the other. In all the models

listed in Tables 8 and 9, the staggered orientation of the two CF_3 groups was assumed. This orientation was assumed since the curves calculated for models corresponding to C, D, E, H, J, K, L and O gave curves that did not agree as well as the curves from the same models but with the staggered orientation.

Three series of models were calculated in which the F-C-F angle was given three different values. The first of these, in which the angle was assumed to be $107\frac{1}{2}^0$ for models corresponding to those in Table 9, gave curves which did not agree at all with the experimental curve. The parameters of the other two series of models with the F-C-F angle equal to $109^028'$ and $111\frac{1}{2}^0$ are given in Tables 8 and 9. The nine curves which agreed qualitatively with the experimental curve are reproduced in Figure 3. The experimental values of the parameters, Table 10, can be interpreted only in light of the fact that for this molecule the range of possible values for the various parameters was not completely covered. Thus, no models were considered in which the C-O-C angle was greater than 130^0, or for which the ratio of the C-O/C-F distances was less than 1.34/1.32.

Furthermore, no attempt was made to determine precisely the F-C-F angle, since only those changes were made in this angle which would not alter the short F-F distance by more than one per cent of the value obtained from the radial distribution curve, which is 2.15 Å.

It is believed, however, that the results do indicate that the C-F distance, which can be determined with a greater precision than the other parameters, has a value which is generally found for the C-F bond distance in aliphatic compounds containing more than one fluorine on the same carbon atom, (i.e., 1.32--1.35 Å). Also, since curves of the models which have a C-O-C bond angle approximately 125^0 give the best agreement with the visual curve, it is believed that this angle is larger in the fluoroether than in dimethylether.

The value for the C-O-C angle in dimethylether and the C-O bond distance have been determined by Brockway (3) to be 1.42 ± 0.03 Å.

Finally, there is reason to believe that the C-O distance is less in the fluoroether than in dimethylether. The value obtained for the former was 1.36 ± 0.04 Å. Since the limits of the values for the C-O bond in the two compounds overlap, it is not possible to state absolutely that this difference is real. 64 pages. $1.00. Mic 56-721

(1) Buck, F. A. M. and Livingston, R. L., Ph. D. Thesis, Purdue University, August 1948.

(2) Pauling, L. and Brockway, L. O., J. Am. Chem. Soc., 59, 1223 (1937).

(3) Brockway, L. O., J. Am. Chem. Soc., 57, 2684 (1935).

CHEMISTRY, PHYSICAL

INFRARED STUDIES ON ISOTOPIC CARBON DIOXIDE

(Publication No. 15,690)

Charles Bradford Arends, Ph.D.
University of Washington, 1955

In this work, the ν_1 fundamental of CO_2 was made infrared active by replacing one normal oxygen atom with its heavier isotope. Both ν_1 and its Fermi resonant companion frequency $2\nu_2$ were observed. Measurement of the vibrational frequencies of all fundamental bands of $CO^{16}O^{18}$ gave values which were in good agreement with those predicted on the basis of Dennison's[1] energy equations. The following table lists both predicted and observed frequencies for $CO^{16}O^{18}$ in cm^{-1}.

Band	ν_1	ν_2^1	$2\nu_2^0$	ν_3
Predicted frequency	1360.3	661.8	1265.3	2339.4
Observed frequency	1367	663	1259	2338

Eggers and Crawford[2] determined the intensity of the ν_3 fundamental of normal CO_2, which leads to a value of the bond moment derivative, $\frac{\partial \mu}{\partial r}$, of 5.85×10^{-10} esu. The intensity sum of ν_1 and $2\nu_2$ measured in this work was 1.67×10^{10} cycles per second and leads to a bond moment derivative value of 5.82×10^{-10} esu. This fortuitously good agreement tends to indicate that the change of bond moment with bond length is not dependent upon the phase relationship between the two equivalently bonded atoms during vibration. A similar conclusion was reached by van Alten[3] in his work on deuterated acetylenes.

A variable thickness, low temperature infrared transmission cell was developed for the remainder of the work. It was based, in part, on the cell of Holden, Taylor and Johnston,[4] but was of a simpler design. Using this cell, intensities were estimated in the solid phase for ν_1 and $2\nu_2$ of $CO^{16}O^{18}$ in addition to the binary combination bands of N_2O. Comparison of these values with the corresponding gas phase intensities leads to the assumption that the two are probably not comparable, except to an order of magnitude. Solid and gas phase intensities are listed below:

$CO^{16}O^{18}$	ν_1	$2\nu_2$
Solid	0.35×10^{10} cycles/second	0.33×10^{10}
Gas	0.919×10^{10}	0.752×10^{10}

N_2O	$\nu_1+\nu_2$	$\nu_1+\nu_3$	$\nu_2+\nu_3$
Solid	1.53×10^{10}	20×10^{10}	1.60×10^{10}
Gas	1.22×10^{10}	104×10^{10}	7.2×10^{10}

Gas phase intensities of N_2O are those reported by Eggers and Crawford.[2] 85 pages. $1.06. Mic 56-722

1. D. M. Dennison, Rev. Mod. Phys. 12, 175, (1940).

2. D. F. Eggers and B. L. Crawford, J. Chem. Phys. 19, 1554, (1951).

3. L. van Alten, Ph.D. Thesis, University of Washington, 1954.

4. R. B. Holden, W. S. Taylor and H. L. Johnston, J. Opt. Soc. Am. 40, 757, (1950).

THE RAMAN EFFECT OF WATER SOLUTIONS OF ELECTROLYTES AND NONELECTROLYTES

(Publication No. 15,359)

John Burnham, Ph.D.
Stanford University, 1955

The structure of water and its solutions of electrolytes and nonelectrolytes has been studied by means of the Raman Effect. An attempt has been made to determine the effect of temperature from the freezing to the critical point of water and to compare the changes observed in the Main Band with that produced by different cations and anions at various concentrations. The effect of diluting water with organic compounds of a polar and nonpolar nature was also studied.

The Raman spectra were obtained on a crystal quartz Cornu prism spectrograph and were excited by monochromatic mercury resonance radiation from a Hg low pressure discharge tube. The high dispersion and freedom from interfering source lines in this region of the spectrum combined with a new high precision microphotometer-comparator has made possible very accurate determinations of the wave number and structure of the Raman lines and bands.

The spectrum for pure water under the high dispersion has proved the existence of three components at room temperature at displacements of 3190, 3440, and 3500 cm^{-1}. As the critical point is reached the band sharpens and has only one definite maximum which reaches 3609 cm^{-1} at 350° C. This compares with 3654 cm^{-1} for water vapor.

The changes have been interpreted in terms of Bernal and Fowler's tetrahedrally co-ordinated model of liquid water and the different components of the Main Band have been correlated with water molecules differing in the number of hydrogen bonds made with their four immediate neighbors.

A value of 4.2 Kcal per mole for the hydrogen bond energy has been empirically derived from the displacement of the maximum of the Main Band relative to that of the vapor.

Strong 1-1 and 2-1 electrolytes cause a sharpening of the Main Band and a decrease of the component $\nu_1(H)$ of the band correlated with tetrahedrally co-ordinated water molecules.

The F^- and OH^- ions show specific effects and cause a broadening of the Main Band. This indicates that these anions cause specific perturbations of the valence vibrations of the H_2O molecule. Thus the sharpening of the band expected from the breaking of hydrogen bonds is obscured.

Mixtures of dioxane of increasing concentration show a progressive sharpening of the Main Band indicating that the dilution of the polar water molecules also results in the breaking up of the co-ordinating bonds. The C-H valence vibrations of the dioxane molecule show no shift indicating that they do not enter into hydrogen bond formation with the water molecules.

This dissertation was completed about 1940 and experimental work was done between 1933 and 1936. A survey of the recent literature given in the Appendix shows that the work done in the intervening years has not materially affected the significance of this work.

505 pages. $6.31. Mic 56-723

PREPARATION AND PROPERTIES OF FIBERS CONTAINING MIXED POLYMERS

(Publication No. 13,674)

David Marshall Cates, Ph.D.
Princeton University, 1955

The polymer pairs, polyacrylonitrile-cellulose acetate (pan/ca) and polyacrylonitrile-silk (pan/silk), were dissolved in a common solvent and extruded as fibers. Fibers of a third polymer pair (pan/cell) were obtained from the former pair by hydrolysis of the cellulose acetate component. Physical and chemical properties of these fibers were studied as a function of their composition.

The X-ray patterns of the pan/ca and pan/cell fibers were a composite of the patterns normally given by the pure polymers. Although the intense pattern of polyacrylonitrile was always present in the diagrams of the pan/silk fibers, typical interferences of the silk component were not observed.

A relationship was established between transparency and the densities of the pan/ca and pan/cell fibers. The pan/ca fibers available in the undrawn state were found to be transparent; density measurements indicated the specific volumes of the components in the mixtures were approximately additive. In the drawn state the pan/ca fibers were opaque, and the specific volumes of the components in the mixtures were not additive. The drawn pan/cell fibers were also opaque, although the opacity of the fibers containing 50% or more cellulose was less than that of the fibers in the pre-hydrolysis state; the specific volumes of the components in the latter compositions were approximately additive. In every composition of the pan/ca and pan/cell fibers in which the specific volumes were not additive, the experimental specific volume was more than that calculated on the basis of additivity.

The behavior of the pan/ca fibers was examined in reagents which either swell or dissolve the cellulose acetate component. The cellulose acetate could be removed by acetone only if the samples contained more than 20% cellulose acetate. The cellulose acetate in samples containing more than 40% cellulose acetate was disoriented by chloroform treatment. The drawn fibers containing 60% or more cellulose acetate were rendered transparent by the action of chloroform and heat.

The moisture regain was observed to increase and the electrical resistivity to decrease as the relative amount of hydrophilic component in the three polymer blends was increased. The amount of dye uptake also appeared to increase with the amount of hydrophilic component present, but the uptake was less than would be expected when the hydrophilic polymer was present as the minor component. It is probable, however, that the dyeing was a nonequilibrium dyeing in these compositions.

The tensile properties of the three types of polymer blends were measured in the air-dry and wet states. In general these properties declined as the relative proportion of polyacrylonitrile present was decreased.

161 pages. $2.01. Mic 56-724

BURNING VELOCITIES OF METHANE AND THEIR INTERPRETATION

(Publication No. 13,676)

William Herbert Clingman Jr., Ph.D.
Princeton University, 1954

In order to elucidate such questions as the mechanism of propagation and general nature of the chemical reactions for hydrocarbon flames an investigation has been conducted of the burning velocity of methane under various conditions. The experimental results have been compared with the Semenov and two modified forms of the Tanford-Pease theories of flame propagation.

An improved Bunsen burner method of determining the burning velocity has been presented in which it is determined for each flame observed whether there is a region of the flame cone over which the flame velocity is constant. Values for the burning velocity are assigned to the mixture only in those cases where such a constant region is found. The method has been shown to give burning velocity values which are independent of flow rate and burner diameter at different total pressures.

The burning velocity of stoichiometric mixtures of methane in nitrogen-air at sub-atmospheric pressures has been found to vary as the -0.25 power of the pressure at one atmosphere and as the -0.5 power at one-half atmosphere. The pressure exponent of stoichiometric methane, helium-air mixtures was found to be -0.2. These results could not be accounted for with the Semenov equation for a bimolecular reaction, which predicted a decrease in burning velocity rather than an increase with decreasing pressure. If a thermal theory is to explain the results, it is necessary to postulate the existence of an important first order reaction in the combustion zone.

In comparing these experimental flame velocities with the Tanford-Pease equation a modification was introduced in that consideration was given to the effect of the thermal conductivity of the mixture on the mean temperature of the reaction zone. This modified Tanford-Pease-I equation was able to account for the observed increase in burning velocity on going from nitrogen-air to helium-air and predicted an increase in flame velocity with decreasing pressure. This latter predicted increase, however, was not as large as that observed experimentally. In order to fully account for the observed effect of pressure on the burning velocity of methane it is necessary to postulate that chain branching and chain ending reactions are important in the combustion zone. A second modification of the Tanford-Pease equation was introduced taking such reactions into consideration. This modified Tanford-Pease-II equation was able to account for the observed rise in burning velocity with decreasing pressure.

The burning velocities of methane were determined at atmospheric pressure and various compositions in nitrogen, argon, and helium "airs." An increase in burning velocity was observed when argon was substituted for nitrogen of about two to one for the stoichiometric mixtures. When helium was substituted for nitrogen an increase in the burning velocity from 40 cm./sec. to 149 cm./sec. was observed for the stoichiometric mixtures. Both forms of the Tanford-Pease equation were generally in better agreement with these results than the Semenov equation. The latter theory predicted a much greater increase in burning velocity than was observed on going from mixtures with nitrogen-air to those with argon-air and helium-air. The Semenov equation also predicted a minimum in the burning velocity at the stoichiometric composition for all three "airs." No experimental evidence, however, was found for such a minimum.

For the rich mixtures the first modification of the Tanford-Pease theory gave low results, the modified Tanford-Pease-II equation being in better agreement with experiment. This behavior has been explained on the basis of chain branching reactions in the combustion zone.

Further evidence for a diffusion mechanism of flame propagation was furnished by a comparison of the burning velocities of methane (CH_4) and heavy methane (CD_4) at atmospheric pressure and in both nitrogen and argon "airs." The Semenov equation again predicted a much greater increase in the burning velocity than was observed on going from nitrogen-air to argon-air. The ratio of the burning velocity of a mixture with CH_4 to that of a mixture with CD_4 of the same composition was always greater than one and increased with increasing concentration of fuel. It is shown that a thermal theory does not account for this increase in the burning velocity ratio if it is assumed that changes in the thermal properties of the system such as thermal conductivity, flame temperature, and heat capacity can be neglected upon replacing CH_4 with CD_4.

149 pages. $1.86. Mic 56-725

NEUTRON IRRADIATION STUDIES ON PHOSPHORUS, CHLORINE, AND SULFUR COMPOUNDS

(Publication No. 15,908)

Paul Kohler Conn, Ph.D.
Kansas State College, 1956

To elucidate further the nature of bond rupture processes in Szilard-Chalmers type reactions, a detailed study of these phenomena was performed on the compound PCl_3 along with more general studies on the compounds PBr_3 and S_2Cl_2. The point in question was the manner in which newly-formed radioactive phosphorus and sulfur lost their energy and recombined into stable chemical combinations. The PCl_3 system was studied as to temperature effects, phase effects, and radiation effects. No variation in the percentage retention was observed. Labeled products identified from these thermal neutron irradiations were as follows: distribution of P^{32} resulting from irradiation of PCl_3 — 89 per cent in PCl_3, 6 per cent in $POCl_3$, and 2 per cent in $PSCl_3$; distribution of S^{35} — this had been studied already and reported as 30 per cent in $PSCl_3$ in M. S. thesis; distribution of P^{32} from irradiation of PBr_3 — essentially 100 per cent in PBr_3; distribution of P^{32} from irradiation of S_2Cl_2 — 4 per cent in PCl_3, 83 per cent in $POCl_3$, 5 per cent in $PSCl_3$, and 5 per cent in phosphorus sulfides; S^{35} distribution — 19 per cent in $PSCl_3$ and the remainder in S_2Cl_2.

Irradiated solutions with added carriers were separated by means of distillation procedures. Because of the possibility of exchange between the carriers and the irradiated solutions, pertinent exchange reactions were studied under the distillation conditions. These were (PCl_3, P^*SCl_3), (S, PS^*Cl_3), (S_2Cl_2, PS^*Cl_3), (PCl_3, P* red) (PCl_3, P* red, 20,700 r of X-rays), and (PCl_3, P* red, 62,100 r of X-rays).

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

The results of the exchange studies were all negative. Improved separation techniques were tested and employed for handling the S_2Cl_2 irradiations. This reduced the total time required for analysis. Also, more sensitive counting techniques were developed and used.

The two theories predominant in the field were considered in some detail in regards to the compounds studied. From the considerations it was shown that the number of energy reducing collisions, as calculated from the "billiard ball" collision theory, and hence the distance of recoil were small — the exact conditions necessary for the application of the "nest of radicals" theory, which was used to explain the results.

Using the "nest of radicals" theory, it was concluded that the bonds of the molecules were broken indiscriminately, leaving the labeled atom in a high concentration of free radicals. The possibility then existed that there was a large number of chlorine and phosphorus atoms in stoichiometric proportion for the reformation of PCl_3 in the near vicinity of the "cooled" P^{32} atom. This factor coupled with the reactivity of the components was used to account for the observed results. The results of the PBr_3 irradiation emphasized the reactivity of the components whereas the results from the S_2Cl_2 irradiations pointed up the significance of stoichiometric proportions as well as reactivity. The presence of labeled $POCl_3$ was attributed to the post irradiation hydrolysis of PCl_5 due to the handling of the sample during separation procedures.

85 pages. $1.06. Mic 56-726

THE MECHANISM OF REINFORCEMENT. VI. THE ELECTRICAL CONDUCTIVITY OF CARBON BLACK-LOADED RUBBER.

(Publication No. 15,688)

James F. Coyle, Ph.D.
The University of Buffalo, 1956

Rubber, unless mixed with certain pigments, is a nonconductor. The electrical conductivity of carbon black-rubber mixtures is of theoretical and practical importance. Conductance is caused primarily by chains of carbon black particles.

Conductivity is affected by the type and amount of carbon black; the former exerts an influence through variation in particle size, crystal structure, and amounts of volatile matter. The degree of dispersion as controlled by the milling time and the viscosity of the mix, the degree of vulcanization, the cure pressure, flexing of the sample, solvent swelling, the magnitude of the applied E.M.F., the relative humidity, the type of elastomer, and the temperature all have an influence.

The effect of the last factor is of interest in that a plot of the resistance vs. time after a sudden temperature change exhibits a sharp maximum or minimum. This suggests a mechanism involving two competing processes, the adsorption of carbon black on carbon black and of rubber on carbon black.

Carbon black-rubber mixtures were compounded, cured, and subjected to sudden temperature changes while their resistances were recorded. The results are plotted as conductance vs. time.

When the temperature was decreased the conductance increased to a maximum, then decreased exponentially. When the temperature was increased the behavior was the reverse. This is explained by the more rapid adsorption of carbon black compared to that of rubber.

If the type of carbon black is changed the adsorption of rubber may be more rapid. In this case the temperature coefficient of resistance may change from positive to negative. Different elastomers, because of their varying degrees of adsorption, affect the results differently.

The logarithms of the specific rate constants, k, for the changes of the ratio, f, of the conductance to equilibrium conductance with time are reported. These were obtained by plotting log df/dt vs. log f and determining the intercept on the log df/dt axis.

Log k is essentially independent of the concentration of carbon black. This suggests a simple mechanism for the conductance change.

The temperature dependence for the change in conductance was determined using three temperatures. The nature of the curves was such that the descending portions, representing adsorption of GR-S onto carbon black, of the 99°C to 39°C and 99°C to 60°C curves and the ascending portions, representing adsorption of both carbon black and GR-S onto carbon black, of the 99°C to 60°C and 99°C to 80°C curves could be compared independently.

The results for the former are -35.7 and -3.5 kcal. per mole and for the latter, 30.4 and 61.2 kcal. per mole for the left and right samples, respectively. The differences in these values are 66.1 and 64.7 kcal. per mole for the left and right samples, respectively. These are the temperature dependences for the adsorption of carbon black onto carbon black. This is in fair agreement with the energy, 58.6 kcal. per mole, of a single carbon to carbon bond.

After a cycle of three temperature increases and decreases the temperature dependences, 30.4 and 61.2 kcal. per mole, decreased to 44% and 54% of their values, respectively. Since, as shown by the correspondence of the values, 66.1 and 64.7 kcal. per mole, the adsorption of carbon black onto carbon black is not affected by slight variations in cure, the observed decrease is attributable to the decreased rate of adsorption of GR-S onto carbon black caused by the formation of cross-links. The sensitivity of the adsorption of GR-S to cure is further evidenced by the discrepancy in the values, -35.7 and -3.5 kcal. per mole, which is most probably due to differences in the degree of original cure of the samples.

84 pages. $1.05. Mic 56-727

THE VIBRATIONAL SPECTRUM AND NORMAL COORDINATE ANALYSIS OF TROPYLIUM BROMIDE

(Publication No. 15,909)

William Gene Fateley, Ph.D.
Kansas State College, 1956

The purpose of this dissertation was to investigate the structure of cycloheptatrienylium (tropylium) ion, $C_7H_7^+$. If this molecule was aromatic as Professor von E. Doering of Yale University had suggested, then it represents a new type of planar, aromatic, seven membered ring system.

Due to the instability of this ion, the electron and X-ray diffraction methods could not be used to determine its

structure; therefore the infrared and Raman spectroscopic methods were used. Extreme precautions were necessary in the filtering of Raman excitation light to prevent the decomposition of the sample. Also the yellow of the sample made it necessary to work with the 5461 Å mercury line. The optimum concentration effect was observed in this compound, but no quantitative work was done to investigate this effect in the tropylium ion's Raman spectrum.

The infrared spectrum contains four fundamental frequencies at 3020, 1477, 992, and 633 cm^{-1} while the Raman spectrum contains six fundamental frequencies at 3075, 3060, 1594, 1210, 868, and 433 cm^{-1}. The observed spectral activity agrees with the predicted spectral activity for a D_{7h} point group configuration with the exception of one unobservable frequency. The carbon-carbon stretching frequency at 1594 cm^{-1} was in the aromatic double bond region. The failure to observe a frequency between the 1600-1700 cm^{-1} eliminated any possibility of a non-aromatic double bond. The carbon-hydrogen stretching frequencies observed were analogous to the type observed in aromatic molecules.

The infrared and Raman spectra were closely analogous to the corresponding spectra of benzene. Some shifts in frequency in tropylium ion as compared to benzene were observed, but this was predictable due to the change in the geometry of the two molecules.

From the number and position of the observable frequencies, and the analogy of tropylium ion's spectra to those of benzene, it was established that the tropylium ion is a planar, aromatic, seven membered ring.

A normal coordinate analysis of tropylium ion checked the frequency assignment and substantiated the D_{7h} type planar aromatic seven membered ring structure.

To carry out the normal coordinate analysis, the D_{7h} multiplication table was constructed. From the multiplication table the irreducible representations were derived and the Nielsen-Berryman method as well as Wilson's method was used to obtain the symmetry coordinates. The kinetic energy matrices of the active species were constructed and the elements of the potential energy matrix were solved for by Wilson's secular determinant condition. The agreement between the valence force symmetry coordinates and of benzene and tropylium ion was remarkable. Also the valence force constants for carbon-hydrogen stretching and carbon-carbon stretching were obtained. The agreement between benzene's force constants and tropylium ion's force constants was conclusive to support the planar aromatic seven membered ring.

131 pages. $1.64. Mic 56-728

THE KINETICS OF THE SILVER(I)-SILVER(II) ISOTOPIC EXCHANGE REACTION IN PERCHLORIC ACID

(Publication No. 15,722)

Barry Maxwell Gordon, Ph.D.
Washington University, 1955

Chairman: Arthur C. Wahl

The silver(I)-silver(II) isotopic exchange reaction in perchloric acid has been studied in order to learn something about the electron-transfer mechanism in aqueous solution. The results were to be compared with those of other cation isotopic exchange reactions in which the charge product of the reactants was greater than in the silver system. These comparisons were not made because the bimolecular silver(I)-silver(II) exchange reaction was masked by a faster reaction causing isotopic equilibration.

The experimentally determined rate law for the exchange reaction ($R = k(Ag^{II})^2$) is consistent with a rapid reversible reaction first postulated by Noyes and co-workers.

$$2\ Ag^{II} \rightleftharpoons Ag^{III} + Ag^{I}$$

The reaction rate constant showed a reciprocal fourth power dependence on hydrogen ion concentration.

The rate constant in 6 F $HClO_4$ at 0°C. is 1020 ± 40 $F^{-1}sec.^{-1}$. The experimental activation energy is 12.5 ± 1.2 kcal/mole.

The fast rate of the reaction and the instability of silver(II) solutions made the reaction too fast to measure by ordinary means. A method which would measure half-times of a few tenths of a second was developed. A rapid mixing flow technique first developed by Hartridge and Roughton was used with success. Reactant solutions were forced through capillaries to mix in a mixing chamber while flowing at a velocity of about 2.5 meters/sec. The reaction solution then passed through reaction tubes and finally into a quenching solution which stopped the reaction. A set of reaction tubes were developed so that the reaction times could be changed for different points in an exchange run. The mixing chamber was constructed of teflon and found to yield a 99% mixing efficiency within four milliseconds after the reactant solutions met. 72 pages. $1.00. Mic 56-729

AN ADIABATIC VACUUM CALORIMETER FOR THE RANGE 15° TO 290°C AND THE HEAT CAPACITIES AND RELATED PROPERTIES OF Mg_3Cd AND $MgCd_3$

(Publication No. 15,089)

William Vanderbilt Johnston, Ph.D.
University of Pittsburgh, 1955

The immediate objective of this investigation has been to obtain precise values of the heat capacities of the alloys of composition Mg_3Cd and $MgCd_3$ in the temperature range from room temperature to 270°C so that these data and thermodynamic functions computed from them may be used in conjunction with other data to obtain (a) a measure of the usefulness of the Kopp-Neumann rule in nonideal alloy systems, (b) a test of the Third Law of Thermodynamics for these intermetallic compounds, (c) thermodynamic properties of formation at 25°C of these compounds, and (d) information on the nature of the order-disorder transformations that might prove useful to those engaged in a theoretical study of the phenomena.

A calorimeter was constructed in which the sample was heated stepwise up the temperature scale with a rating period before and after each heating period to determine that equilibrium is established before heating again. The calorimeter is a modification for temperature up to 300°C of the low temperature vacuum adiabatic calorimeters in use in a number of laboratories. The modifications consisted chiefly in the use of temperature-resistant wire

insulation and higher melting solders. The capsule-type platinum-resistance thermometer was mounted inside the sample container which also contained helium at eight centimeters pressure. The adiabatic shield was controlled manually to 0.002 degrees. The temperature and energy-measuring circuits were conventional.

The samples used were made from the highest purity components available, and the Mg_3Cd and $MgCd_3$ contained 24.98 per cent cadmium and 74.98 per cent cadmium, respectively. The thermal history was carefully controlled during the course of the measurements.

The measurements on Mg_3Cd indicated that at the beginning of disorder around 35°C there was a sudden sharp rise in the heat capacity accompanied by a considerable delay in the attainment of equilibrium. The attainment of equilibrium became rapid again at 70°C and remained so until approximately 135°C. Equilibrium was delayed between 135°C and the disorder point at 150.6°C, after which it remained rapid. The time of equilibration began to increase for $MgCd_3$ at 25°C and remained slow past the disorder point of 83.8°C up to 95°C. Several determinations were followed for 19 hours before equilibrium was attained.

The configurational heat contents and entropies for Mg_3Cd were 400 calories/gram atom and 1.02 E.U., respectively. The configurational heat contents and entropies for $MgCd_3$ were 344 calories and 1.02 E.U., respectively.

The standard heats, entropies, and free energies of formation at 25°C calculated in conjunction with other data were -1311 ± 16 calories, -0.11 ± 0.03 E.U., and ± 1278 ± 20 calories, respectively, for Mg_3Cd, and -1123 ± 16 calories, + 0.17 ± 0.03 E.U., and -1174 ± 17 calories, respectively, for $MgCd_3$.

Residual entropies as calculated by the Third Law of Thermodynamics were + 0.13 ± 0.05 E.U. for Mg_3Cd and + 0.195 ± 0.04 E.U. for $MgCd_3$. The residual entropy for Mg_3Cd was shown by means of an extrapolation to low temperature using a Bragg-Williams type calculation to be due to frozen in disorder. The frozen in disorder in $MgCd_3$ is quite small, but calculations made of the entropy due to 1.7 per cent Shottky defects in the lattice, as shown by a comparison of x-ray densities and directly determined densities, indicate that the 0.17 E.U. so obtained will reduce the residual entropy to within the limits of experimental error.

A consideration of all the errors involved indicates that an average precision of 0.15 per cent was obtained for Mg_3Cd in the temperature range studied and 0.20 per cent for $MgCd_3$. 106 pages. $1.33. Mic 56-730

ABSOLUTE PRIMARY QUANTUM YIELDS OF IODINE DISSOCIATION IN NON-POLAR SOLVENTS

(Publication No. 15,744)

Frederick Walter Lampe, Ph.D.
Columbia University, 1953

Allyl iodide, in the presence of air, has been used as a scavenger for photochemically produced iodine atoms in inert solvents. The results of rate studies furnish confirmation of a previously proposed mechanism of the iodine-sensitized photochemical decomposition of allyl iodide and permit calculation of absolute quantum efficiencies for production of iodine atoms which escape recombination with their original partners in the undissociated molecule.

Primary quantum yields of the photo dissociation of iodine and allyl iodide in hexane, carbon tetrachloride, and hexachlorobutadiene-1,3 have been determined. A comparison of the quantum yields in the three solvents has shown that they are in agreement with the theory of a solvent cage effect operating in solution and lowering the quantum yield from a value of unity in the gas phase.

A temperature dependence of the primary quantum yield has been observed for which there seems no simple interpretation at the present time.

By combining the results of these studies with previously published data on photostationary iodine atom concentration measurements, the rate constants for iodine atom combination in hexane and carbon tetrachloride have been calculated and have been shown to be in the same ratio as the approximate diffusion coefficients of iodine atoms in the two solvents. 105 pages. $1.31. Mic 56-731

A SHOCK TUBE INVESTIGATION OF THE HYDROGEN-BROMINE REACTION BETWEEN 800°K. AND 1000°K.

(Publication No. 15,648)

Myron Nieveen Plooster, Ph.D.
Princeton University, 1955

The hydrogen-bromine reaction at temperatures between 800 and 1000°K has been studied using a modified shock tube technique. The method originated by Zeldovitch, in which the atmosphere of the room is utilized to compress a gas sample originally at a pressure of less than one atmosphere, was used to attain the desired high temperatures. It is shown that the assumptions made by Zeldovitch concerning the compression process in this system, (1) that the temperatures attained by compression may be calculated assuming a reversible adiabatic compression, disregarding the effects of the shock waves, and (2) that the terminal pressure of the process is in all cases one atmosphere, are in error. A study of the strengths of the shock waves in the system was carried out, showing that (1) the shock waves generated in the system produce temperatures considerably higher than those calculated assuming a reversible adiabatic process, and (2) the terminal pressure of the process was in general greater than one atmosphere. It is also shown that in this system, with a high-pressure reservoir of essentially infinite diameter, the shock waves produced are stronger than those predicted by the theory for a shock tube of uniform cross-section at a given ratio of pressures at the diaphragm, in agreement with the theory of Lukasiewicz.

The reaction process was studied by measuring photometrically the changes in Br_2 concentration in the compressed, heated gas. Reaction appeared to take place by a near-adiabatic thermal explosion mechanism. From the induction periods of the thermal explosions it is shown that reaction was slower than would be predicted by the extrapolated rate of the low-temperature reaction, with an apparently lowered activation energy.

An approximate theoretical treatment of the behavior of the hydrogen-bromine reaction under non-steady-state

reaction conditions is presented. Since the compression process appears more rapid than the rate of approach of the concentrations of H and Br atoms to their steady state values at the high temperatures reached by the compression process, these concentrations are taken to be zero at the instant of attainment of the maximum temperature by compression. Satisfactory agreement is found between the experimentally observed induction periods and those calculated on the basis of a non-steady-state reaction. Exact agreement between theory and experiment is difficult to obtain because (1) there is some scatter in the experimental data and (2) the rates of dissociation of Br_2 molecules and recombination of Br atoms are very uncertain. 83 pages. $1.04. Mic 56-732

THE VAPOR PHASE PHOTOLYSIS OF TRIFLUOROACETOPHENONE AND MIXTURES OF TRIFLUOROACETOPHENONE AND TRIFLUOROACETONE

(Publication No. 15,889)

Robert Miles Smith, Ph.D.
The Ohio State University, 1955

The vapor phase photolysis of trifluoroacetophenone at 3660A., 3130A., and full mercury arc radiation has been studied between 160° and 340°C.

The effects of temperature, light intensity, and pressure give evidence for the following proposed mechanism:

Primary Processes:

$$CF_3COC_6H_5 + h\nu \longrightarrow CF_3CO + C_6H_5 \quad \text{I}$$
$$\searrow CF_3 + COC_6H_5 \quad \text{II}$$

Secondary Reactions:

$$CF_3 + CF_3COC_6H_5 \longrightarrow CF_3H + CF_3COC_6H_4 \quad (2)$$
$$2CF_3 \longrightarrow C_2F_6 \quad (3)$$
$$CF_3 + CF_3COC_6H_5 \longrightarrow CF_3COC_6H_5CF_3 \quad (4)$$
$$CF_3 + CF_3COC_6H_5CF_3 \longrightarrow CF_3COC_6H_5(CF_3)_2 \quad (5)$$
$$2C_6H_5CO \longrightarrow (C_6H_5CO)_2 \quad (6)$$
$$C_6H_5 + CF_3COC_6H_5 \longrightarrow C_6H_6 + CF_3COC_6H_4 \quad (7)$$
$$CF_3CO \longrightarrow CF_3 + CO \quad (8)$$
$$C_6H_5CO \longrightarrow C_6H_5 + CO \quad (9)$$
$$CF_3CO + \text{Wall} \longrightarrow \text{Products} \quad (10)$$
$$CF_3 + \text{Wall} \longrightarrow \text{Products} \quad (11)$$
$$C_6H_5CO + \text{Wall} \longrightarrow \text{Products} \quad (12)$$

The pressure effect showed that reaction 10 becomes less important as compared with reaction 8 as the pressure is increased.

The temperature coefficient of reactions 2 and 3 gives

$$E_2 - E_3/2 = 7.2 \pm 0.5 \text{ kcal/mole},$$

and a collision theory steric factor ratio of

$$\frac{P_2}{P_3^{1/2}} = 10^{-4} \text{ to } 10^{-6}$$

Mixtures of trifluoroacetophenone, A, and trifluoroacetone, B, were photolyzed at 3130A.

The results of these experiments, together with the results of further photolyses of B alone, confirm the high temperature chain mechanism involving CH_3 radicals in the photolysis of B (Sieger, R. A., and Calvert, J. G., J. Am. Chem. Soc., 76, 5197 [1954]). In addition, a previously undetected short chain involving CF_3 radicals was found at 346°C.

From the experimental evidence, the previously proposed chain-carrying reactions 13 and 14 appear unlikely

$$CF_3 + CF_3COCH_3 \rightleftharpoons (CF_3)_2COCH_3 \quad (13)$$
$$(CF_3)_2COCH_3 \longrightarrow CF_3COCF_3 + CH_3 \quad (14)$$

since no hexafluoroacetone was detected. Reactions 15 and 16 are proposed as the ones continuing the chain.

$$CF_3 + CF_3COCH_3(\text{Wall?}) \longrightarrow (X) \quad (15)$$
$$(X) \longrightarrow CH_3 + \text{nonvolatile products} \quad (16)$$

93 pages. $1.16. Mic 56-733

THE STRUCTURES OF BINARY CRYSTALLINE FLUORIDES

(Publication No. 15,764)

William Gordon Thomas, Ph.D.
Michigan State University, 1954

Structural data for a large number of the binary crystalline fluorides are not available. The structures of the higher fluorides which have been reported are, in general, not well established. X-ray single crystal investigations are the best means of obtaining structural data. However, the lack of single crystals suitable for such investigations has prevented the determination of many structures. It appears that the structural data for many binary crystalline fluorides must be obtained from detailed study and calculations based on powder diffraction photographs. This dissertation discusses the structures of manganic fluoride, silver difluoride, chromic fluoride trihydrate, chromium tetrafluoride, chromic fluoride, and stannic fluoride, based on X-ray powder diffraction photographs.

Manganic fluoride reacts with moisture quite readily, silver difluoride is extremely reactive, chromium tetrafluoride hydrolyzes easily, and stannic fluoride is hygroscopic. Short capillary tubes were packed with each of the materials in a dry box and X-ray powder diffraction photographs were prepared. Photographs were prepared for all the materials except manganic fluoride and stannic fluoride using copper Kα radiation, for all the materials except chromium tetrafluoride using molybdenum Kα radiation, and for manganic fluoride using iron Kα radiation.

Analysis of the data for manganic fluoride led to the proposal of a distorted bimolecular rhombohedral unit cell, with lattice parameters as follows: $a_0 = b_0 = 5.31 \pm 0.02$ Å., $c_0 = 5.50 \pm 0.02$ Å., $\alpha = \beta = 56°40' \pm 10'$, $\gamma = 57° \pm 10'$. C_i^1 has been selected as the most probable space-group. Calculation of the relative intensities of the diffraction arcs for seventeen proposed atomic arrangements, followed by comparison with the observed intensities, led to the selection of atomic positions as follows: Mn at 0,0,0; 1/2,1/2,1/2; F at $\pm$.25,.66,.84; $\pm$.84,.25,.66; $\pm$.66,.84,.25. This corresponds to an atomic arrangement similar to that of aluminum

fluoride in which each Mn^{+3} is surrounded by six F^- in a distorted octahedron. The calculated density agrees well with the observed value.

The unit cells of chromic fluoride trihydrate, chromic fluoride, and stannic fluoride have been determined as follows: for chromic fluoride trihydrate, a hexagonal unit cell with a_0 = 5.41±0.02 Å., c_0 = 8.31±0.02 Å., three molecules per unit cell, and a calculated density of 3.86 grams per cubic centimeter; for chromic fluoride, a hexagonal unit cell with a_0 = 5.2±0.1 Å., c_0 = 6.4±0.1 Å., three molecules per unit cell, and a calculated density of 3.63 grams per cubic centimeter compared to a value of 3.8 found in the literature; for stannic fluoride, a tetragonal unit cell with a_0 = 5.71±0.02 Å., and c_0 = 8.32±0.02 Å., four molecules per unit cell, and a calculated density of 4.77 grams per cubic centimeter compared to a value of 4.780 found in the literature. Chromium tetrafluoride gave no diffraction pattern and is assumed to be amorphous. Several possible unit cells for silver difluoride are discussed. Assignment of space-group and determination of atomic positions was possible only for manganic fluoride.

164 pages. $2.05. Mic 56-734

MECHANICAL PROPERTIES OF CELLULOSE ACETATE FILMS AS RELATED TO DEGREE OF POLYMERIZATION DISTRIBUTIONS

(Publication No. 15,674)

Rutherford Boston Thompson, Jr., Ph.D.
Virginia Polytechnic Institute, 1953

Approximately 1,800 grams of commercial cellulose acetate were fractionally precipitated from acetone-water solution by the addition of a solution of n-heptane and acetone, and by lowering the temperature. By recombining the fractions in varying proportions blends were prepared with certain D. P. distributions. Films were cast from acetone solutions of both the fractions and the blends. These films were conditioned and various mechanical properties were determined at 25°C ± 1°C and 50% ± 2% relative humidity. Both the blends and the fractions were refractionated, and the D. P. values were determined by the Staudinger viscosity method, in order to determine their D. P. distribution curves.

The mechanical properties of the fractions when plotted against the average D. P. showed that at a D. P. of 60 or less the films were too brittle to form coherent films and were thus assigned a zero value for all mechanical properties. From a D. P. of 60 to a value in the range of 100 to 150 there was a rapid increase in mechanical properties, and above this there was little or no change in the mechanical properties. A plot of the mechanical properties of the blends against either their weight average D. P. or against their number average D. P. showed no apparent relation.

The mechanical properties of the blends were shown to be approximately a weight average of the mechanical properties of the components.

In correlating the mechanical properties of cellulose acetate films to the shape of the distribution curves, three factors relating to the shape of these curves were considered: (1) the D. P. which was present in the greatest quantity (p_m), (2) the amount of this D. P. which was present (h_m), and (3) the degree of asymmetry which the distribution curve possessed (s_m). These three factors were apparently sufficient to describe the shape of the distribution curve as it affected the mechanical properties when used in the relationship:

$$S = \frac{203}{p_m - 60} + \frac{15.7}{\frac{100\, s_m}{p_m} + 4.00} + \frac{1}{h_m}$$

where:

S = the shape factor.

With this shape factor the mechanical properties of both fractions and blends could be expressed by an equation of the type:

$$1/M = k\,S + k'$$

where:

M = the mechanical property studied
k & k′ = constants.

It was noticed that the data for folding endurance did not fit this type of equation as well as might have been expected, but that if low D. P. material were considered as having a plasticizing action, the shape factor could be modified so as to bring these data into agreement. Thus, a modified shape factor (S′) was developed for fold endurance tests alone as:

$$S' = S + 0.0153\, p_{.05} - 1.32$$

where:

$p_{.05}$ = the five percentile.

When this modified shape factor was substituted for the original shape factor all of the data were brought into good agreement with the developed equation, though some slight modification of the values of the constants was made to give even better correlation.

118 pages. $1.48. Mic 56-735

PROTON HYPERFINE INTERACTIONS IN THE PARAMAGNETIC RESONANCE OF SEMIQUINONES

(Publication No. 15,752)

Balu Venkataraman, Ph.D.
Columbia University, 1955

Semiquinones formed by the oxidation of hydroquinone or the reduction of quinone in alkaline media have been studied by paramagnetic resonance absorption spectroscopy. The p-benzosemiquinone ion has been observed for the first time in solution and the paramagnetic spectra of all the methyl-substituted p-benzosemiquinone ions have been studied and completely interpreted. The other free radicals examined include the monotert- and the 2,5-ditert-butyl-p-benzosemiquinone ions, 9,10-phenanthrenesemiquinone ion and the radical formed from a mixture of benzil and benzoin. Evidence was found for the existence of two or more radicals in an alkaline alcoholic solution of p-benzoquinone exposed to the air.

All the semiquinones possess spectra rich in hyperfine structure, and it is shown that this structure arises from the intramolecular magnetic hyperfine interaction between protons and the unpaired electron. The hyperfine interaction constant for the protons in the ordinary and methyl-substituted p-benzosemiquinone ions is of the order of 2 gauss.

Configuration interaction between π and σ states is suggested to explain the interaction between a ring-proton and the odd-electron. The observed interaction between the odd-electron and the methyl-protons is believed to provide the first direct confirmation, by detailed physical measurement, of the phenomenon of hyperconjugation.

The hyperfine structure of the spectra of the methyl-substituted semiquinone ions has been used to study the effect of substitution on the distribution of the unpaired electron. The odd-electron density at a ring-proton or at a methyl-proton decreases substantially when a methyl group is substituted ortho to the proton of interest; substitution in the meta or para positions, on the other hand, increases the odd-electron density slightly.

112 pages. $1.40. Mic 56-736

ECONOMICS

ECONOMICS, GENERAL

THE IMPACT OF UNIONISM ON ANNUAL EARNINGS: A CASE STUDY INVOLVING LOCOMOTIVE ENGINEERS AND FIREMEN AND TELEPHONE LINEMEN AND SERVICEMEN

(Publication No. 15,700)

Adam Gifford, Ph.D.
University of Washington, 1955

This paper was undertaken in order to investigate the impact of unionism on the annual earnings of selected occupations. The study combines the advantages of two types of earnings structures researches: (1) those that investigate the impact of unionism on the interindustry earnings structure, in which the chief advantage is the availability of data; (2) those that investigate the impact of unionism on the occupational earnings structure, in which the chief advantage is control over skill composition. To gain these advantages, occupations were selected that were almost entirely within particular industries and which also had similar earnings-determining variables.

The period covered by the study is 1939 through 1949. During this period, one group of occupations studied (locomotive firemen and engineers) was highly unionized, while the other (telephone linemen and servicemen) was becoming unionized.

The nature and order of magnitude of the relationship between the degree of unionism and changes in the degree of unionism on the one hand, and annual earnings and changes in annual earnings in the selected occupations on the other were empirically explored in the following manner:

1. The differentials in annual earnings between the unionized and unionizing occupations in the years 1939 and 1949 were investigated. To isolate the impact of unionism on the level of earnings, other variables for each occupation were examined in order to determine the quantitative significance of each variable. The evidence does not indicate that differences in the degree of unionism explained much of the differential in annual earnings among the occupations in 1939 and 1949.
2. The differential change in the level of annual earnings among the occupations over the period 1939 through 1949 was investigated to determine if developing unionism played a significant role in this change. Earnings-determining variables on the supply and demand sides were carefully explored. The evidence indicates that developing unionism had little effect on the differential change in the level of earnings of unionized versus unionizing occupations over the period.
3. Labor's "share" in average gross value productivity over the period studied does not indicate any significant earnings advantage to the workers in the industry and occupation in which unionism was developing.
4. Time series correlations were computed for each occupational group over the period studied between standardized annual earnings with "fringe items" included and such wage-influencing variables as average gross value product, average revenue per employee, the profit-value added ratio, and the wage bill as a percentage of total costs. The results do not indicate that wage rigidities were introduced by unionism.
5. There seems to be no evidence that unionism introduced leads or lags in the movements of earnings relative to other variables among the groups studied.
6. Finally, the impact of unionism and changes in unionism of the variability of annual earnings was investigated. The interquartile range and the coefficient of variation for the years 1939 and 1949 for the selected occupations do not evidence any significant influence of unionism on the variability of annual earnings.

The role of government in the wage bargain during the period for the occupations under study was investigated. It is concluded that government interference may rechannelize fundamental market forces without changing the significance of these forces in wage determination.

The impact of unionism on the annual earnings of the occupations in this case study seems to be small. The level and changes in the level of annual earnings of locomotive firemen and engineers and telephone linemen and servicemen during the period 1939 through 1949 seems to be explained by fundamental market forces, without reference to institutional factors such as unionism and government.

272 pages. $3.40. Mic 56-737

ECONOMICS OF THE SOVIET ELECTRIC POWER INDUSTRY

(Publication No. 12,438)

John Pearce Hardt, Ph.D.
Columbia University, 1955

"Communism is Soviet rule plus electrification of the entire country." This statement of Lenin's has often been used by Soviet leaders to characterize the distinctive Soviet method of industrial development. Still, the development of the Soviet electric power industry from 1928 to 1950, the first four Five-Year Plan periods, was similar in many ways to the expansion of electric power industries in western countries during the same time period. Choices

among investment and production alternatives in the Soviet electric power industry were based on alternative cost relationships similar to those faced in the electric power industry in the United States.

The rapid expansion in the kilowatt capacity installed and the kilowatt-hours of electric energy generated in the Soviet Union led to a narrowing in the ratio of Soviet to American electric power output in the period from 1928 to 1950. By 1950 the ratio of Soviet to American electric power generation per capita had been reduced to 1 to 5 from a ratio of 1 to 24 in 1928.

The comparative measure of electric power generation would be more favorable to the Soviet Union if industrial consumption of electric energy in the two countries were considered. There has been a much greater preference for industry in the allocation of electric energy in the Soviet Union than in the United States throughout the period under study.

On the other hand, the ratio would be somewhat broadened if the low quality of the electric power supply for Soviet industry were considered. Soviet industrial production was continually hampered by insufficient supplies of electric power during periods of maximum demand because the capacity reserves were lower than required to provide continuous electric power supply. Unfulfilled capacity installation plans and frequent breakdowns in equipment were responsible for these inadequate capacity reserves.

There was a definite trend toward the choice of the more capital intensive alternatives in investment decisions on location, type, and scale of Soviet generating stations. The average length of transmission lines per kilowatt capacity increased as stations were located farther from load centers and many electric power systems were interconnected. More of the installed capacity was in steam by-product and hydroelectric stations in 1950, whereas in 1928 the preponderance of capacity was installed in steam condensing stations. The maximum and average scale of electric power plants and stations increased throughout the period, except for the years from 1939 to 1945 when the criticism of "gigantomania" was in fashion.

There was also a trend to capital intensity in production decisions. Automation and mechanization of Soviet station and system operation was particularly important in the postwar period.

The preference for more capital intensive investment and production alternatives was common to the western as well as the Soviet electric power industry during the period under study.

Coal and lignite had become the fuel source for over four-fifths of the electric energy generated in Soviet steam stations in 1950. However, the quality of coal and lignite burned was much below the average consumed in any western countries with the exception of Germany.

Present indications are that the trend toward more capital intensive investment and production decisions will continue throughout the fifth and sixth Five-Year Plan periods. Although the expansion in kilowatt capacity and kilowatt-hour generation is to be greater than in any previous plan periods, there is reason to believe that Soviet electrification will not meet the pace set in the American electric power industry during this period.

428 pages. $5.35. Mic 56-738

PROBLEMS OF DEVELOPING AGRICULTURAL COOPERATION IN DEVELOPMENT OF UNDERDEVELOPED COUNTRIES

(Publication No. 15,225)

Wei Jen Huang, Ph.D.
University of Illinois, 1955

A striking world economic feature in recent years is the interest shown in the economic development of underdeveloped countries. Underdeveloped countries, covering a very large area in the world exist in the Caribbean region, most of South America, Africa, southeast Europe, the Middle East, Asia, south southeast Asia. In all of them agricultural production predominates. The proportion of their population engaging in agriculture is more than 50 percent of the total population and their national income from agriculture is at least 50 percent.

The general characteristics of the economy of the underdeveloped countries can be summed up thus: their people suffer extreme poverty; their productivity is low; their incomes are low; their living standard is low.

The rural areas of the underdeveloped countries are still more impressively underdeveloped and their economy stagnant. Many factors impede their development. In many countries, the backwardness of the agrarian structure and of their particular systems of land tenure is a major handicap. Among the features of land tenure characteristic of most underdeveloped countries are high rents, uneconomic holdings of the farmers, fragmentation of tracts as owned and as operated into a multiplicity of plots, and general insecurity of occupancy by tenants and subtenants. Moreover, the agrarian structure is greatly strained by high taxes imposing severe burdens on small farmers and farm laborers. Further handicap results from the lack of satisfactory credit facilities. Low local prices realized from the marketing of farm products give the small farmers little chance to get ahead. Lack of scientific methods of farming, and inadequate education for the farmers have tended to keep farm productivity low. The productivity is usually so low that farmers in general are able to save little or nothing from their earnings. The volume of capital produced by small farmers is seldom abundant enough to support needed investments in their farms.

For the purposes of this study development can be measured on three different bases, aggregate physical output, output per capita, and capital-income ratio. In order to improve the rural situation of underdeveloped countries major dependence can be placed upon organized effort of the small farmers. Farmers have it in their range of choice to use the cooperative form of business to integrate procurement, selling and service functions and in appropriate instances to use cooperation in production itself.

The motive prompting farmers to own and operate cooperative is largely economic. It springs from desire to increase the net income from farming, improve the techniques. Results achieved in many situations have made for efficiency in production and thereby have improved levels of living of farm families and rural communities. A great deal of work remains to be done within existing rudimentary organizations. Cooperative societies which have sprung up in underdeveloped countries are in many cases far from perfect; to improve their methods of working and their structures is an important next step.

198 pages. $2.48. Mic 56-739

A STUDY OF THE ECONOMY OF A RICE GROWING VILLAGE IN CENTRAL THAILAND

(Publication No. 15,491)

Kamol Odd Janlekha, Ph.D.
Cornell University, 1955

The purpose of this study is to locate current economic problems in Bangchan, a village chosen as representative of commercial rice growing villages in central Thailand.

Bangchan, which has a population of about 1,600, is located 20 miles from Bangkok. The field work was conducted in Bangchan during two periods, the first period starting in September, 1948 and ending in July, 1949, and the second period starting in August, 1952 and ending in December, 1953. Throughout both periods of study, four daily visits in each week were made to the village with a weekly overnight stay. All interviews and enumeration work were made by the author himself.

The study is divided into three parts: Part I dealing with the community and community economy; Part II with business and living aspects of the farm; and Part III with economic problems of the village.

Major findings of this study may be summarized as follows:

The average degree of self-sufficiency of farms in Bangchan is found to be 52 per cent, indicating that rice growing even in what is recognized as the commercial rice area of Thailand is in large part a subsistence type of agriculture. Farmers fish freely in the open canals, and fish constitutes practically all the protein intake of the villagers. The abrupt decrease in the fish supply, which was noticed in a short period of two or three years, thus poses a serious problem.

Incomes of the farmers were found to be low. This was due primarily to population pressure which did not permit these farmers to operate an efficient size farm, and also to limited opportunity for other jobs. For tenant farmers, the problem was aggravated by the fact that the landlords' share of output was increasing.

Through foreign exchange control, the government has kept farm prices of paddy at a low level. Prices of the things the farmers buy, however, have not been effectively controlled.

Finally, the problem is further complicated by the shortage of cash and credit in the village which resulted in high rates of interest. Farmers with incomes at the bare subsistence level, constituting a large proportion of the village total, were especially adversely affected. The result is that the gap between affluent and non-affluent farmers is increasing. 436 pages. $5.45. Mic 56-740

THE MERGER MOVEMENT IN MANUFACTURING AND MINING, 1895-1907

(Publication No. 15,745)

Ralph Lowell Nelson, Ph.D.
Columbia University, 1955

This is an empirical study of the first and largest merger movement in the United States, centering about the years 1898-1902. There is still a wide area of disagreement over the causes and significance of this first great merger wave, due in part to the lack of comprehensive and detailed data describing the movement. It was to improve and augment the empirical descriptions of the movement that this study was undertaken.

Although comprehensive lists of early mergers had been compiled before this study, they were found to lack sufficient detail in description to permit extended analyses of the movement. The present study employed a greater variety of information sources, and a more thorough compilation and verification procedure, resulting in a more comprehensive coverage of the mergers of the period. On the basis of the number and size of merging firms the present study describes an early merger movement roughly one-fourth larger than the largest of the earlier estimates.

Examination of various aspects of the merger movement reveals that the movement was more widespread than hitherto believed, reaching into a great variety of industries, and resulting in the formation of many medium-sized firms in addition to the well known large consolidations. The multiple-firm merger was dominant in this period, with approximately three-fourths of all firm disappearances occurring through the simultaneous union of five or more firms.

The merger information collected in this study permitted detailed tests of four theories of the merger movement. The theory that retardation in industry growth was a cause of the merger movement was shown not to accord with the facts. There was a general reversal in industry growth retardation in this period, and the reversal was even more vigorous in the industries of highest absolute and relative merger activity.

Serious questions were raised about the theory that the growth of the nation's transportation system broke down the distance barriers to inter-firm competition and thus caused firms to merge. Though the transportation system grew rapidly in the years before the merger movement, it was found that there was relatively less merger activity in industries having wide geographical dispersion than in concentrated industries. Moreover, this inverse relationship between geographical dispersion and merger activity was most pronounced in industries having high unit transportation costs relative to product price.

Evidence was found to support the theory that the development of the organized market for industrial securities was an important immediate cause of the merger movement. The stock exchanges grew rapidly in the twenty-five years preceding the turn of the century, reaching by that time a plateau of activity not to be exceeded for two decades. Approximately two-thirds of merger capitalizations were listed and traded on the New York Stock Exchange. Merger activity showed a moderate positive responsiveness to stock price changes, while exhibiting a much lower responsiveness to production level changes.

The desire for monopoly was shown to have played at least a permissive role in the merger movement. From two-thirds to three-fourths of merger activity resulted in the formation of firms having a dominant share of their markets. Supplementary evidence suggests that, given the contributory conditions of a receptive capital market and permissive corporation laws, the promise of monopoly profits was a frequent and effective argument in persuading independent firms to surrender their sovereignty.

238 pages. $2.98. Mic 56-741

ECONOMIC IMPLICATIONS OF THE GUARANTEED ANNUAL WAGE FOR THE BASIC IRON AND STEEL INDUSTRY

(Publication No. 15,108)

Charles Soltis, Ph.D.
University of Pittsburgh, 1955

The current interest in guaranteed annual wages differs substantially from that in experiments of previous years. Today, organized labor, through strong unions, including the United Steelworkers of America, is making the demand for wage guarantees an issue in collective bargaining. In the past, management, for the most part, unilaterally installed the guarantee and retained all responsibility.

Economically, too much should not be expected of wage guarantees. Guaranteed wages are but one procedure that may be used in a full-scale attack upon unemployment and insecurity. Their adoption will not eliminate or even greatly mitigate the business cycle.

The current movement can be traced to the 1943 demand of the United Steelworkers for a full-time guarantee for all employees with three or more months of service. The Union did not gain the guarantee either from the companies or from the National War Labor Board. However, upon the recommendation of the NWLB, the federal government did sponsor a study of the principles and implications of wage guarantees, the Latimer Report, probably the most thorough analysis of wage guarantees ever undertaken.

The Latimer report is doubly important in that its recommendations were almost entirely adopted by the Union and made the basis of their demand in later negotiations. Recent demands have been mainly for a guarantee that would be extended only to employees with a specified minimum length of service. Benefits are to be paid as supplements to unemployment compensation. However, numerous obstacles do not facilitate private supplementation of unemployment compensation.

In the steel industry, interest in guaranteed wages was enhanced by the problem of increasing unemployment in 1952-1954. However, on the basis of a guarantee of 52 weeks a year, 30 hours per week, for all employees with a minimum of three years of service, gross costs for idle time during the entire three-year period would have approximated but 0.003 cents per actual hour worked.

There is always some danger that wage guarantees will have adverse effects - that is, that they will increase the amount of unemployment. One way in which this may occur is by possible effect on the break-even point of a firm. Profits are undoubtedly a major business motive. A guarantee may so increase the fixed charges of a business that the break-even point will be so raised that the firm will lose money even when business fluctuations are minor.

In the period 1952 through 1954, rough calculations indicate that the break-even points for U. S. Steel, Bethlehem, Jones and Laughlin, and Republic were approximately 39, 30, 49, and 30 per cent of capacity operations, respectively. Under a wage guarantee that would require the companies to contribute an average of $120 a year per wage earner into a trust fund, break-even points for these same firms would have been increased approximately three per cent, to an average of 42, 33, 52, and 33 per cent, respectively.

Any company may, of course, extend some kind of guarantee to its employees, with some advantage to all parties. Inasmuch as the central problem seems to be that of required payment for idle time, management will be pressed to investigate the various possibilities of limiting gross costs. The complicated problem may be so resolved. Meanwhile, supplementation of unemployment reserves represents a real gain.

258 pages. $3.23. Mic 56-742

ECONOMICS, AGRICULTURAL

AN APPRAISAL OF THE PRAIRIE FARM ASSISTANCE ACT

(Publication No. 15,482)

Melvin Emil Andal, Ph.D.
Michigan State University, 1954

The Prairie Farm Assistance Act was established in 1939 to assist agriculture in western Canada. The program provided for payments to farmers of a maximum of $500 when the yield of wheat was zero to four bushels per acre and a maximum of $300 when the yield was more than four but not more than eight bushels per acre. A levy of one per cent was made on sales of grain through commercial channels and the money so raised was available for the payment of benefits. Additional funds required were obtained from the central treasury. Up to and including the crop year 1951-52, more than 143 million dollars were paid in benefits and collections under the one per cent levy amounted to 64.3 million dollars.

The operation of the program has raised questions as to its effect on resource allocation and on farm income stability. In addition, the actuarial structure of the insurance aspect of the Act and the effectiveness of the operating machinery warranted study. Basic data were obtained on all of the townships which had benefited under the Act between 1939 and 1949. These numbered nearly five thousand. Also, nearly 5,500 records on individual farms in a sample of 59 townships in Saskatchewan were used.

Compared with a model crop insurance program, the program of the Prairie Farm Assistance Act lacked some of the important requirements. The program involved continuous and substantial subsidies. Also, between farms there was an inverse relationship between risks and levy or premiums. Farms receiving the largest benefits paid the smallest premiums and vice versa.

Under certain conditions the program tended to promote misallocated resources as exemplified by the payment of benefits to farms on submarginal land. In addition, the payments were not large enough to improve resource allocation by removing the causes for risk aversion on the part of farmers and capital rationing on the part of lenders. The amount of stability provided was not sufficient to meet what is considered to be minimum stability requirements. Other limitations included the double tax on ineligible grain producers, the exemption of flax from the levy and lack of uniformity in the provision of benefits in the eight to twelve

bushel category when the price of wheat drops below eighty cents per bushel.

In order that crop insurance functions can be more fully provided, it is recommended that, with the approval of the farmers, certain changes be incorporated into the Act. These include: a generally higher levy and one which takes into account the different categories of risk which exist between areas; maximum payments to farmers should be increased to provide a greater amount of stability and to remove causes for misallocated resources; payments to farms on submarginal land should be made conditional upon following certain practices; the levy should be placed on flax; all producers should be made eligible, or, exempt those from the levy who are ineligible for benefits; and the price policy feature of the Act should be made uniform for all categories.

224 pages. $2.80. Mic 56-743

ECONOMICS, COMMERCIAL BUSINESS

THE SEAFOOD INDUSTRY OF THE CHESAPEAKE BAY STATES OF MARYLAND AND VIRGINIA (A STUDY IN PRIVATE MANAGEMENT AND PUBLIC POLICY)

(Publication No. 15,747)

Charles Loreaux Quittmeyer, Ph.D.
Columbia University, 1955

There are income-producing activities other than the fishing industry which are more important in general to the Chesapeake Bay region. Nevertheless, the fishing industry is a significant primary industry for the Bay region, particularly so for some individual counties. However, it is a marginal industry with major marketing, sociological and political problems. In the light of these problems, conditions for developmental policy of the industry might well be viewed in terms of how favorable are the factors of size of resource; prospects for market expansion; competitive marketing advantages; control of production and demand; climate of laws, public aid, and governmental cooperation; and sensitivity to public and private interest and support. Although a great deal of study in the past has been given to the biological and physical aspects of the industry, very little attention has been given to the marketing aspects and hence to the circumstances under which seafood of the Chesapeake Bay area may profitably be marketed.

Despite the fact that the Chesapeake Bay area affords a rich source of seafood supply, there are many obstacles in turning this supply into marketing profitability. Lack of control over most species, instability and scattering of supply, and restrictive laws tend to cause high costs of production. However, from the standpoint of both supply and demand, shellfish have a strong competitive advantage over finfish in the Bay area. Still, there is much improvement possible for both shellfish and finfish propagation, harvesting, processing, and distributing.

On the demand side, it is clear that seafood from the Bay area has, with the exception of oysters, been losing its share of the market to seafood from other regions. This is largely a result of the modernization of competitive seafood in fitting itself to the mass market for food by quick-freezing, packaging, and promotion. Inability and inertia of Bay area producers to move quickly into the same type of modernization has held back development of the Bay seafood industry. Both high production costs because of supply problems and a lack of sensitivity to demands of institutional and ultimate consumers have given rise to this inability and inertia.

The managerial weakness in failure to tackle more broadly and imaginatively the problems of supply and distribution seem to be more human than technical. For example, under a program which would reduce the restrictions on leasing of private oyster ground, it is conceivable that the supply of oysters would be easily increased several times and that unit costs of production could be materially decreased. At the same time, closer attention to improving the taste and promotion of oysters might well open a profitable market for a concomitant large supply.

Indeed, the technical efficiency alone of the channels of distribution now in effect seems adequate except for some problems in carrying out the functions of merchandising and market information.

The policy of private interests will veer toward efforts guided by estimates of individual profitability. State policy will lie within the province of broad research and perhaps Bay-wide attempts to manage supply. Federal policy will be pointed in the direction of even broader research than that done at the state level.

In perspective, the fishing industry of the Chesapeake Bay region is confounded by a clash of what is good from a marketing standpoint and what is feasible biologically, technologically, socially, and politically. It is further confounded by a lack of understanding at each level of production and distribution concerning product-planning and control of quality. Still, in this subsidized industry incomes are generally fair for the standard of living locally accepted and return on capital, at least for the larger dealers, seems good. 555 pages. $6.94. Mic 56-744

THE MARKETING OF PREFABRICATED HOUSES

(Publication No. 15,900)

Theodore Russell Yantis, Ph.D.
The Ohio State University, 1955

Prefabrication of houses created the problem of how best to market in standardized form a product which, it has long been thought, should be custom-made for the individual purchaser. Some factors affecting the market for prefabricated houses are consumer acceptance, local building restrictions, minimum standards established by governmental agencies, availability of mortgage money, and attitudes of lending institution executives. The market is a highly competitive one since it becomes a part of the residential real estate market.

A discussion and an analysis of the practices, procedures, and policies followed by selected prefabricated house manufacturers and dealers in the areas of selling, financing, erecting, and servicing the prefabricated house

are presented. The historical background of prefabrication and its influence on marketing, the problem of selecting a channel of distribution, and the relationships existing between manufacturers and dealers in the industry are also considered.

The statistical data are primarily the results of interviews conducted with 43 manufacturers and 120 dealers actively engaged in prefabrication who are widely distributed geographically throughout the United States.

Two basic points of view have developed concerning the place of prefabrication in the house-building industry. The one followed by many leading producers is based on the concept of a standardized, brand-named product, mass produced, advertised to ultimate consumers, and distributed by dealers who are controlled in selling, erecting, and servicing the product. The opposing point of view follows the concept that the prefabricated house manufacturer is a service agency midway between the supplier of raw materials and the local project builder. Many manufacturers try to combine the two concepts by attempting to standardize the product and build to the customers' specifications in periods of slow demand.

Some actual or potential advantages accruing to the industry which are examined in the dissertation include the following: (1) lower costs, (2) savings in site labor, (3) rapid erection, (4) more rapid turnover of capital, (5) quotation of a firm price, (6) the use of quality materials, (7) benefits of factory engineering, (8) lower subcontracting costs, (9) off-season construction, and (10) other benefits derived from being a part of a large organization. Some disadvantages limiting the progress of the prefabricated house industry are (1) standardization of the product, (2) geographic preference for a specific building material, (3) local building code compliance, (4) low percentage of total house price represented by house package, (5) impracticability of higher degree of prefabrication in the house package, and (6) influence of mortgage lenders.

As the study indicates, the idea that the house-building industry could be revolutionized by prefabrication gave way to an evolutionary concept as manufacturers returned to the use of the same types of materials and styles of architecture as those used by conventional builders. Progress has been slow in capturing a substantial portion of the residential house market, and it is concluded that the use of prefabricated house components will increase in the house-construction industry for local lumber yards and builders as well as for prefabricated house manufacturers and dealers. Prefabrication of houses will not attain its potential until new technology and new materials, more adaptable to mass production, are developed, accepted by customers, approved by governmental agencies and financial institutions, and used in the prefabricated house industry. 280 pages. $3.50. Mic 56-745

ECONOMICS, FINANCE

ELASTIC STIMULANTS, INSTITUTIONAL DEPRESSANTS AND ECONOMIC BALANCE: A NEW APPROACH TO THE PROBLEM OF ECONOMIC INSTABILITY AND DEPRESSIONS

(Publication No. 15,730)

John Samuel Atlee, Ph.D.
Columbia University, 1955

This is a functional analysis of the American economy, using what might be called a "financial-institutional" approach. It has a dual focus: first on the dynamic balance between gross liquid saving and the financial outlets for such saving (as distinguished from the balance between saving and investment as national income magnitudes); secondly on the institutional factors which influence the total volume of liquid saving and the profitable volume of business investment and external financing.

Primary emphasis is on the non-sustainable, or "elastic" stimulation of economic activity derived from:

(1) Expansion of consumer credit at a rate faster than disposable personal income (with resulting increases in debt-to-value and debt-to-income ratios);

(2) Non-sustainable rates or types of business investment in connection with such factors as inventory expansion, filling of investment "backlogs," construction of competitive excess capacity, investment by uneconomic "marginal" firms under an "umbrella" of monopolistic prices, and foreign investment;

(3) Factors in business finance such as the expansion of trade credit or leasing arrangements, cash purchases of smaller or weaker firms, the operating losses of weaker firms, stock market and real-estate booms, and business overconfidence;

(4) Expansion of government debt.

To emphasize the fact that this elastic stimulation is derived primarily from financial-structural changes rather than cyclical changes, the statistical analysis is focused on two relatively sustained periods of postwar "full-employment prosperity," 1923-29 and 1947-53. During these two periods consumer instalment and home mortgage credit increased three to six times as rapidly as disposable income. An estimate of the "elastic" or non-sustainable component in their increase (Table 2) indicates that the elastic stimulation from these two factors alone (aside from the many others mentioned above) contributed to effective consumer purchasing power fully half as much as did the increase in Disposable Personal Income (DPI), and provided an outlet for approximately 25% of the gross personal liquid saving advanced through financial channels. The total increase in these two types of credit accounted for over half of the increase in GNP, and "offset" about 40% of liquid saving—an indication of the great analytical and strategic significance of these two factors.

The fact that unemployment could increase, the prices level off and decline, while the economy was still under the powerful inflationary influence of this elastic stimulation seems to indicate that there were counteracting deflationary forces in the economy. Factors which would tend to have such an effect include: (1) inequality of bargaining power, or "monopoly," (which tends to cause "excessive" profits, "excessive" concentration of incomes, and insufficient investment opportunities); (2) the uncertainty and

risk arising from continued economic instability and recurrent depressions (which must be offset in business and personal financial planning), and (3) the fact that expansion of the money supply is largely dependent on expansion of debt (bank loans). Because these factors are more or less inherent in a non-centrally-planned, private enterprise economy, they are called "institutional" depressants.

It is suggested that with the development of an adequate system of flow-of-funds accounting and statistical data for the other elastic stimulants, it may become possible to calculate currently the balance between elastic stimulation and the effects of the institutional depressants, and thus to obtain a more effective tool for economic analysis and prediction.

In terms of its policy implications, this analysis would put less stress on "counter-cyclical finance" (which in practice tends to mean government deficit finance), and more stress on structural reforms designed to reduce the effects of the institutional depressants.

203 pages. $2.54. Mic 56-746

ECONOMICS, THEORY

INTERNATIONAL TRADE BETWEEN FREE AND CONTROLLED ECONOMIES: THEORETICAL IMPLICATIONS AND POLICIES

(Publication No. 15,826)

Rimmer de Vries, Ph.D.
The Ohio State University, 1955

The rise of Soviet power augmented the significance of trade between free and controlled economies. Its theoretical and practical implications, including appropriate policies, have become significant to the free economies in the world. The study is an attempt to clarify this problem of trade between free and controlled economies. It presents certain implications of trade between a purely-free-market and a purely centrally controlled economy. Also, it includes a critical historical analysis of economic policies concerning operational relations of trade between free and controlled economies.

The general equilibrium type of economic theory is used as basic methodological procedure. An analysis is made of equilibrium relations of households and firms of a free-market economy, and of the Board in a centrally controlled economy. Trade between free-market and centrally controlled economies is not compatible with these equilibrium conditions unless appropriate economic policy is formulated in order to offset the disturbances.

International trade in free markets develops from the economic calculations of private importers and exporters. They may trade with any country of the free-market system in which multilateral trade and convertibility of currencies exist. In a centrally controlled economy, the Board is autonomous in making decisions concerning international trade. In considers simultaneously exports and imports; prefers barter or bilateralism; dispenses with a rate of exchange; and plans a currency which is inconvertible. The aim of gaining complete control over the economic activities of the nation may induce the Board to adopt a policy of autarky or a policy of economic imperialism, i.e., the establishment of its economic control abroad. The latter is demonstrated in Soviet-satellite relations.

Trade between free-market and centrally controlled economies disturbs the process of planning of the Board, which must remain incomplete and subject to the uncertainties and fluctuations of the free-market economic process. The calculations of the private firm of free economies are disturbed because the Board keeps its economy isolated and separated from the free world market; it is autonomous and commercially unpredictable in determining demand conditions; it is able as a supplier to undercut suddenly competitive prices; it is monopolistic in trade transactions; and it is biased toward balanced bilateralism and aggressive discriminatory practices. Thus, theoretically, trade between the two pure economic systems is incompatible. In practice, operational relations between free and controlled economies must be based on impure elements in these economies.

In order to expand such trade, specific arrangements must be made and included in a bilateral trade agreement. Its content depends on such factors as the extent to which free and controlled economies deviate from their pure models (i.e., the willingness of free economies to increase some direct controls and the willingness of the Board to accept some uncertainties in foreign trade) and the relative bargaining strength of the partners, which depends partly on the possession of alternative markets.

Specific arrangements can cope reasonably well with the effects of undercutting prices, with instability of trade, with bargaining power, and with trading techniques. However, to avoid the spread of bilateralism free economies must make global purchasing arrangements with controlled economies. To avoid discriminatory practices they must seek alternative free markets, adjust to the world economy, and pursue policies of full employment, monetary equilibrium, and economic development.

Thus, if a number of economic and political conditions are fulfilled—if neither economy is dogmatic toward its pure economic model and if each is tolerant in political aspirations—appreciable trade between opposing kinds of economic systems may develop. Nevertheless, this trade is likely to remain of secondary importance as compared with the trade among free economies and the trade among controlled economies. 338 pages. $4.23. Mic 56-747

EDUCATION, GENERAL

THE EFFECT OF THE STUDY OF HIGH SCHOOL BOOKKEEPING UPON ACHIEVEMENT IN ELEMENTARY COLLEGE ACCOUNTING

(Publication No. 15,808)

Edna Hollar Barbour, Ph.D.
The Ohio State University, 1955

The purpose of the study was to determine whether the study of bookkeeping in high school contributes to achievement in accounting in college.

Evidence concerning the similarity and dissimilarity of accounting and bookkeeping courses was obtained by comparing the objectives of the bookkeeping and accounting courses given by leading business educators and authors of bookkeeping and accounting textbooks; by comparing the number of pages devoted to topics in three bookkeeping and two accounting textbooks; by comparing topics and questions included in tests furnished by bookkeeping textbook publishers and tests used at one university for a period of three years; by comparing terms used in accounting tests and bookkeeping textbooks.

Questionnaires were used to obtain opinions of 117 accounting students, 108 bookkeeping teachers, and 98 accounting instructors concerning the value of studying bookkeeping before accounting.

Sixty-six accounting students who had studied bookkeeping were matched with 66 students who had not studied bookkeeping on the basis of age, sex, intelligence, college attended, previous college credit hours, high school and college grade average, and high school and college mathematics courses. These students were studying accounting in two junior colleges and two four-year colleges. The first- and second-semester mean accounting grades of the matched students who had studied bookkeeping and the students who had not studied bookkeeping were obtained. Correlations were made of the bookkeeping grade and the accounting grade; the number of semesters of bookkeeping studied and the accounting grade; and the years elapsing between the study of bookkeeping and accounting and the accounting grade.

The conclusions reached were:

1. The major difference between the objectives of bookkeeping and accounting courses is that of emphasis, which varies as a result of the fact that the two courses are designed for different occupational levels.
2. The amount of overlapping in the content of first-year bookkeeping and first-semester accounting courses is considerable. The overlapping in the content of second-year bookkeeping and second-semester accounting is considerably less than the overlapping between first-year bookkeeping and first-semester accounting.
3. Accounting instructors have no decided preference for students with previous bookkeeping instruction.
4. Bookkeeping teachers are almost unanimous in the opinion that bookkeeping is of value to students who take college accounting.
5. Accounting students believe that a study of bookkeeping helps in the study of accounting.
6. Students who take bookkeeping in high school make significantly higher grades in first-semester accounting and higher grades in second-semester accounting than do students of equal ability and background who have had no bookkeeping.
7. High grades in bookkeeping will predict at least average or higher grades in first-semester accounting, but average or below-average grades in bookkeeping have no predictive value. The bookkeeping grade cannot be used to predict the second-semester accounting grade.
8. Students who had studied two semesters of bookkeeping made better first- and second-semester accounting grades than students who had studied bookkeeping one semester. However, students who had taken two years of bookkeeping appear to have no advantage over students who have taken one year of bookkeeping.
9. The time elapsing between the study of bookkeeping and the study of accounting has no direct effect on either the first- or second-semester accounting grade.

304 pages. $3.80. Mic 56-748

RELATION OF WORK EXPERIENCE IN INDUSTRY TO INDUSTRIAL ARTS TEACHING PRACTICES AND SUCCESS

(Publication No. 14,948)

Thomas Rawleigh Gaines, Ed.D.
University of Missouri, 1955

Major Adviser: H. H. London

Purpose of the Study: To ascertain the relationship of work experience in industry to teaching practices and rated teaching success of industrial arts teachers.

Method of Research: Information regarding the amount and type of industrial work experience and teaching practices followed by industrial arts teachers was obtained through an information form. A jury of fifty industrial arts teacher education specialists evaluated the teaching practices involved. Ratings of teaching success were obtained from eighty-eight local industrial arts supervisors on a scale constructed for this purpose. Fifty-one teachers with no work experience in industry and ninety-eight teachers who had worked four or more years in industry were compared: (1) with each other on teaching practices followed, (2) with specialists recommendations on the use of these practices, and (3) with each other on supervisory ratings of teaching success.

Summary: The chief findings of the study are as follows:

Other than work experience in industry, the only significant difference in the background and characteristics of the teachers studied was that of teaching experience. Work experience teachers had taught industrial arts, on the average, 3.10 years longer than non-work experience teachers.

No significant differences were found between non-work and work experience teachers on teaching practices followed regarding: conservation of students' time in school shop work, project cost and elimination of waste, selection of course content, teaching methods and techniques, shop housekeeping, and shop management.

One significant difference was found between non-work and work experience teachers on teaching practices followed regarding industrial arts shop safety, and care and maintenance of equipment.

Both teacher groups tended to differ, and to about the same degree, in the extent of use of practices from that recommended by the specialists.

Non-work and work experience teachers did not differ significantly on any of the eighteen items rated by the supervisors on teaching success.

Conclusions: College cooperative industrial work experience programs do not play a prominent part in the training and experience of industrial arts shop teachers.

The need for skilled labor during the period of and since World War II offered opportunity for full-time summer work experience, and for full-time and part-time year-round work experience in industry for industrial arts teachers desirous of gaining such experience.

Industrial arts teachers tend to seek and find employment in industry in keeping with their training and background of a technical and skilled nature.

There seems to be little or no relationship between whether or not industrial arts teachers have work experience in industry and the teaching practices followed regarding:

a. Conservation of students' time in school shop work
b. Project cost and elimination of waste
c. Selection of course content
d. Teaching methods and techniques
e. Industrial arts shop safety
f. Care and maintenance of equipment
g. Shop housekeeping
h. Shop management

There seems to be little or no relationship between whether or not industrial arts teachers have work experience in industry and the teaching success ratings given by industrial arts supervisors.

186 pages. $2.33. Mic 56-749

AN INVESTIGATION OF THE VERBAL MATTER IN RECENTLY PUBLISHED ARITHMETIC TEXTBOOKS AND WORKBOOKS FOR THE INTERMEDIATE GRADES

(Publication No. 15,112)

Ralph Glott, Ed.D.
University of Pittsburgh, 1955

This investigation was undertaken to determine the readability levels of recently published arithmetic textbooks and accompanying workbooks for the intermediate grades. The determination of the readability levels of the verbal matter in the statement problems and in the developmental and explanatory material of the textbooks and workbooks formed a part of the study. An additional phase of the study was to determine the extent of gradation of the verbal matter within the textbooks. The latest publications (1950-1954) of arithmetic textbook and workbook series for use in grades four, five, and six formed the nucleus of the study.

Recently, a number of formulae have been developed to estimate the grade level of textbooks by using the sampling technique. An examination of the readability formulae in use today shows a great diversity in method as well as in amount of time required for their use. The Yoakam Technique was chosen because it not only met the criteria of reliability and validity but also was most economical of time.

The application of the Yoakam Readability Formula to the recently published arithmetic textbooks and workbooks for the intermediate grades reveals that the publishers and authors are succeeding in reducing the vocabulary burden to the extent that most of the textbooks and workbooks are within or below grade-range expectancy. A comparison of the reading-grade levels as predicted by the Yoakam Technique, with the levels designated by the publishers revealed that in the 269 samples of materials used, 11 per cent were above grade range, 44 per cent were within grade range, and 45 per cent were below grade range. According to the Thorndike list of vocabulary difficulty approximately two per cent of the scaled words rated at the fourth thousand or above. However, an average of the scaled words in each area of the investigation shows that 30 per cent of the words rated above the tenth thousand. The inference to be drawn here is that although the vocabulary load is not heavy, care must be exercised in introducing and teaching many words, especially the semi-technical and technical vocabulary.

A comparison of the grade placement of the verbal matter in the textbooks and workbooks as a whole with the vocabulary found in statement problems and in developmental and explanatory material shows that the verbal matter found in problem solving is the most difficult. In a comparison between the verbal matter found in problem solving and vocabulary used in developmental and explanatory material, the grade placement of problem-solving material was considerably higher.

The findings in this study indicate that there are extreme internal variations in the readability levels of the sections within the textbooks. No evidence of a progressive rise in difficulty within the textbooks of the series examined was found.

The investigation shows that intermediate arithmetic textbooks and workbooks do not present a vocabulary

burden beyond the grade range for which they are intended. There is an evident need for further study on factors other than vocabulary which may cause difficulty in problem solving. Improved gradation within arithmetic textbooks will probably result in increased readability.

118 pages. $1.48. Mic 56-750

AFTER-GRADUATION EDUCATIONAL PLANS OF HIGH SCHOOL SENIORS IN THE CLARK COLLEGE SERVICE AREA

(Publication No. 15,652)

Myrel James Greenshields, Ed.D.
State College of Washington, 1955

The purpose of this study was to ascertain the influence which Clark College, a community (junior) college, has on the post-high school educational plans of the high school seniors in its service area. Data on college-going plans were obtained from 927 seniors of the 1955 graduating classes of the eight public high schools in the proximity of Clark College. Significant relationships were found between plans to attend college or not to attend college, as well as the choice to attend Clark College or a college elsewhere, and the following factors:

1. the high school attended.
2. quartile rank in high school achievement.
3. marital status.
4. sex.
5. rural and urban residence.
6. source of family income.
7. economic status of family.
8. attitude of family.
9. occupation of father.
10. education of father.
11. distance from Clark College.
12. ability of family to pay school expenses.

Whether or not the mother was employed outside the home had no significant relationship to the senior's decision to attend college, or, if the senior planned to attend college, on his choice of college. The education of the mother was related to the decision to attend college, but it was not related to the choice of college.

The reasons for going to college as given by boys and girls were quite similar. Reasons most often identified were (1) preparation for a good job, (2) training for a specific vocation, and (3) a desire for a college education, which was not explained.

The reasons for not going to college as given by boys and girls were significantly different. Girls, more often than boys, did not plan to go to college (1) because they didn't have the money, (2) because they didn't like school, and (3) because marriage plans interfered. Boys, more often than girls, did not plan to go to college (1) because they were going into the service, (2) because they felt they could not succeed in college, and (3) because they had no college objective.

It was found that Clark College had the greatest effect on the post-high school educational plans of seniors (1) if they ranked in the 2nd quartile of their class, (2) if they lived on a farm, (3) if the source of family income was from wages, (4) if the family had the necessities but not many luxuries, (5) if the attitude of the family toward college education was rather indifferent, (6) if his father had less than a college education, (7) if he lived less than five miles from Clark College, (8) if his family could afford to pay only some of his school expenses, (9) if he never had the money to go to another college, and (10) if he wanted to take terminal-vocational training.

Based on these findings, the conclusion was reached that Clark College has a significant effect on the post-high school educational plans of high school seniors in its service area.

179 pages. $2.24. Mic 56-751

A SURVEY AND ANALYSIS OF TEACHER OPINION IN SEVEN AREAS WHICH AFFECT CLASSROOM TEACHING

(Publication No. 15,663)

Arthur William Hilding, Ed.D.
State College of Washington, 1955

This study attempted to determine the opinions of teachers regarding selected school and community factors which affect classroom instruction. There were five instruments constructed and administered, with the assistance of teachers, administrators, and college staff members, before the final instrument was deemed adequate for the survey. The selected factors seemed to fall into seven categories: The Superintendent, The Principal, The Teachers, The Supervisors, The Parents, The Boards of Education, and The Communities. Each category contained eleven items to be rated by the rank order method on a positive basis of "most characteristic" to "least characteristic". This positive approach to evaluation was used in order to encourage constructive rather than critical evaluation of the seven categories.

There were 515 urban and 327 rural teachers returning completed instruments in the study. These included reasonable proportions of urban and rural teachers by teaching levels, geographical areas, and various size communities in the State of Washington. Breakdowns of responses were for the statewide group of 842 teachers, 187 rural elementary teachers, 115 rural secondary teachers, 329 urban elementary teachers, and 117 urban secondary teachers. Only the statewide responses of the 94 junior high school teachers were tabulated and analyzed due to the small number of respondents. In analyzing the responses of these groups of teachers, the following data seemed most significant:

1. Teachers indicated that their superintendents were efficient in the performance of their administrative duties. However, the teachers seemed to feel a lack of teacher participation in the formulation of the school policy and planning.
2. The principals were considerate and helpful and consulted teachers in the routine administration of the school. Teachers felt that there was a lack of advance planning of events and activities and that teacher participation in planning was lacking. Unsatisfactory policies for handling disciplinary problems were also indicated.

3. Although parents supported the school programs and activities, the teachers felt that parents were less concerned with participation in educational meetings, P. T. A., and teacher conferences. A large majority of teachers indicated that the parents did not contact the school for facts whenever conflicts arose between the child and his school.

4. Whereas the teachers felt that the other teachers cooperated in the presentation of programs for the public, they indicated there was grumbling and critical comparison of teacher duties and assignments and that teachers did not encourage their fellow teachers to experiment or try out new methods.

5. Elementary teachers indicated a higher degree of teacher morale than did the secondary school teachers.

6. Teachers indicated that they believed the communities were proud of their schools and supported them to the best of their financial ability but tended to place undue emphasis upon athletic teams, bands, choruses, and other competitive activities.

In analyzing the results of the study, the following general conclusions seemed worthy of further study for improvement:

1. Superintendents should possibly devote part of their time to the development of better relations with the the staff. More teacher participation in policy making and school planning could be utilized.

2. The principals tended to devote much of their time to routine administrative detail. More time might be used for over-all school planning and the inclusion of teacher planning in the school.

3. Better relationships between teachers might be encouraged by the introduction of more democratic practices in school planning and assignment of duties.

4. Better understandings might be developed between parents and teachers. The contributions of parents to the total development of the child need to be determined.

5. The communities tended to emphasize the competitive aspects of the school program. Possibly the school fails to publicize the other important aspects of the curriculum.

6. Teacher training institutions possibly should revise their graduate training programs and provide administrators and teachers with experiences in democratic participation in school planning.

133 pages. $1.66. Mic 56-752

AN ANALYSIS OF THE GUIDANCE POSSIBILITIES IN FOUR SUBJECT AREAS OF SECONDARY SCHOOLS WITH ENROLLMENTS OF 500 AND OVER IN THE STATE OF WASHINGTON

(Publication No. 15,713)

William Rosenblum, Ph.D.
University of Washington, 1955

Supervisors: Dr. John E. Corbally
Dr. Edgar M. Draper

The materials which follow are based upon a normative survey with questionnaires as the data-gathering media made in the Fall of 1949. At that time, 1,534 questionnaires were distributed among social science, language arts, mathematics and science teachers of Washington State public secondary schools with enrollments of 500 and over. One hundred and eleven questionnaires were sent to the counselors of these schools. Sixty-two per cent of the teacher questionnaires and ninety-five per cent of the counselor questionnaires were returned in completed form.

The study represented an effort to obtain information relative to the possibilities of including guidance activities as a part of the instructional techniques to be employed by teachers in following the curricula of the respective subjects surveyed. The activities mentioned are those which may be developed through the use of the techniques and tools of guidance as an integral part of teaching procedures regardless of the subject matter involved. For purposes of specific comparisons, the responses of junior-senior, senior and junior high school teachers in the subject fields, as well as those of school counselors, were tabulated separately.

Statistical analysis of the questionnaires indicated that the majority of teachers believed they could carry on guidance activities as a part of regular classroom teaching on time schedules in effect at the time of the study. This majority also indicated that twenty-seven students should be the maximum class size in which any amount of effective guidance could be given. Most of the counselors surveyed felt that teachers are capable of effecting this integration of subject matter and guidance.

The areas which were found to be common to all of the subjects surveyed, and in which there were possibilities of integrating guidance activities with subject matter included:

1. Orientation. Most of the teachers devoted a maximum period of five days to the orientation of their students to the materials to be studied.

2. Study techniques. The teachers, in large numbers, indicated that they taught their students how to study their respective course offerings. However, they did not find the results of such teaching generally gratifying, for all teachers listed poor study habits as a very important problem area in their subjects.

3. Individual difference. The majority of teachers were not making, through their teaching procedures, provision for the individual differences of their terminal and non-terminal students.

4. Motivation. Most of the teachers indicate that if their respective course offerings could be made more interesting and meaningful for students, there

would be an appreciable increase in the students' knowledge and application.

5. Health. There were many problems of physical growth and development which the teachers indicated resulted in marked differences in the ability of students to carry on normal class activities. The factors which were checked with the greatest frequency by all teachers were poor sight and poor hearing.

6. Vocational information. Most of the teachers reported that they informed their students with respect to those occupations which require previous training in pertinent subject matter. This information was generally given informally and not as a part of the teaching procedures.

7. Pupil failures. With regard to students receiving failing grades in subject matter, the majority of teachers indicated their desire to be of assistance within the confines of the classroom rather than to make referrals to other school personnel.

It is significant that over fifty-nine per cent of all of the teachers had not taken more than six quarter hours of course work in guidance during the ten year period preceding the study. Such courses should help equip teachers for successful integration of guidance activities and subject matter. 352 pages. $4.40. Mic 56-753

A STUDY OF VOCABULARY EMPHASIS AND CONCOMITANT READING SCORES AT THE JUNIOR HIGH SCHOOL LEVEL

(Publication No. 15,716)

Sylvia Freda Vopni, Ph.D.
University of Washington, 1955

Supervisor: Francis F. Powers, Ph.D.

A review of literature on vocabulary development and reading improvement supported the hypothesis that direct teaching of vocabulary led to increased competence and efficiency in reading. At the elementary school level, research on the vocabularies of children was basic in the development of reading programs. Beyond the elementary school level, vocabulary emphasis was limited generally to the development of technical vocabularies, to the incidental acquisition of vocabulary through wide reading, and to special remedial techniques for retarded readers. This study attempted to demonstrate that extensive vocabulary emphasis in all curriculum areas at the junior high school level was effective in improving reading scores on a standardized test of reading vocabulary and reading comprehension.

The vocabulary to be emphasized was selected from the Thorndike-Lorge Teacher's Word Book of 30,000 Words. Proper nouns, words occurring once or less per million printed words, as indicated by the count, and words occurring so frequently as to be considered already part of the reading vocabulary of most children entering the seventh grade were excluded from further consideration for the purposes of this study. The remaining body of words in the middle range of frequency of occurrence was divided into three levels of decreasing frequency, one level for each of grades seven, eight, and nine. The word lists for grade levels were searched for words correlated with areas of subject-matter in the curriculum. Words were distributed approximately equally among major areas of study and were presented as eighteen lists of twenty words in each of these major curriculum areas for each grade level. These lists were not limited to technical vocabulary of the subject. Word lists were duplicated for classroom use, but teachers were free to select or devise their own methods of presentation and word study. A wide variety of methods and procedures was reported.

Experimental and control groups were selected from six junior high schools in a metropolitan school district, those schools in which the mean scores of a sample on tests of verbal meaning and mental capacity were clustered about the city-wide median. In the three experimental schools, school-wide emphasis was given to vocabulary in all curriculum areas, without de-emphasizing usual educational goals. In the three control schools, the usual curriculum and procedures were followed. Approximately half the pupils at grades seven, eight, and nine in each of the participating schools, both experimental and control, were given the California Reading Test, Intermediate, both at the beginning of the semester of the study and at the conclusion of the semester. The time available for the study was limited to one semester, allowing seventy-two teaching days to intervene between tests. Gains in reading scores were compared for various groups stratified by grade, sex, curriculum elected, and the order in which alternate forms of the test had been administered.

In eleven separate tests of the null hypothesis, the gains of the emphasis or experimental group exceeded the gains of the control group in nine instances. Individual tests favoring the emphasis group were significant at the five per cent level only for the group electing Spanish in the seventh grade. However, the aggregate of tests of significance, when combined by a procedure suggested by R. A. Fisher, supported the conclusion that the procedure of extensive, school-wide emphasis on vocabulary in the middle range of the Thorndike frequencies produced greater gains in reading achievement, as measured by gains on reading test scores, than the usual procedure.

Materials used were evaluated by teachers for purposes of revision. The study supported the use of a variety of methods to expand reading recognition vocabulary on an extensive scale at the junior high school level. A unique feature of the experimental program was the provision, in every subject-matter area, of lists of words of moderate frequency of occurrence, words in quantities exceeding vocabulary lists usually used.

263 pages. $3.29. Mic 56-754

EDUCATION, ADMINISTRATION

PUBLIC SCHOOL MAINTENANCE, INSTALLATION, AND CONSTRUCTION JOBS PERFORMED BY OR UNDER THE DIRECTION OF INDUSTRIAL ARTS TEACHERS

(Publication No. 14,943)

Ernest George Bednar, Ed.D.
University of Missouri, 1955

Major Adviser: H. H. London

Purpose of Study: To ascertain the practices of industrial arts teachers in the performance of maintenance, installation, and construction jobs for the industrial arts shop and for the school, and to obtain their opinions concerning these activities.

Sources of Data: Data for the study were obtained through an information form mailed to a random sample of 1,000 industrial arts teachers in public secondary schools throughout the United States. There were 425 information forms returned and of these 392 were retained for the study.

Findings and Conclusions: The maintenance and construction jobs which were performed most frequently by the industrial arts teachers and their students were: "preparing equipment for vacations," "painting equipment," "resurfacing bench tops," "constructing shop made jigs and equipment," and "making stands for equipment." The times during which these jobs were performed were, in order of frequency, (1) during class time, (2) during vacant periods, and (3) after school hours.

The instructors felt that only a very few of the shop maintenance and construction jobs, and none of the general maintenance and installation jobs should normally be performed by the shop teacher. They felt that performing excessive work of this nature themselves had an adverse influence upon their teaching effectiveness.

Industrial arts teachers believed that the expansion of the "do it yourself" movement was increasing the need for providing well selected shop maintenance and construction experiences for secondary school industrial arts students.

Industrial arts teachers reported that they lacked sufficient "time," "equipment," and "training" to perform all of the maintenance, installation, and construction jobs which confronted them.

A large majority of the industrial arts teachers expressed the opinion that a required course in shop maintenance should be offered for industrial arts majors on the undergraduate level and an elective course of this nature for graduates in this field.

Recommendations: Since a large majority of the students majoring in industrial arts in college will be expected to either perform or supervise the performance of much of the shop maintenance and construction work when they go out into the field, they should receive sufficient training in the performance of these jobs while in college.

Industrial arts teachers, who are expected to perform maintenance and construction jobs, should be allowed extra free time from class work to accomplish this work without jepordizing the quality of their instruction. They should also receive extra compensation for general school maintenance and construction work performed outside of school hours.

The instructor should provide sufficient opportunity for secondary school students to learn such maintenance and construction jobs as students might encounter in a home workshop and send the remainder to be performed by either a maintenance staff or a qualified specialist in this work outside the school.

Since industrial arts is considered a necessary and desirable part of general education, facilities, such as laboratory, tools, equipment, storage racks, display cases, etc., should be provided for in the planning and construction of the school building, just as they are provided for other practical arts and physical science courses, rather than expecting the industrial arts teacher to construct these necessary teaching facilities on his own time. 141 pages. $1.76. Mic 56-755

A STUDY OF CERTAIN SMALL SCHOOL DISTRICTS MAINTAINING HIGH SCHOOLS IN MISSOURI

(Publication No. 14,944)

Steven H. Byham, Ed.D.
University of Missouri, 1955

Major Adviser: W. W. Carpenter

Purpose: The major purpose of this study was to compare the school districts in the state with total enrollments of 200 or fewer pupils maintaining high schools. This comparison was interpreted in terms of educational efficiency and economy in our present day society. In order to do this, it was necessary to take into consideration the costs and the services of the other schools of the state for purposes of comparison.

Method of Research: The study sought to determine the trend toward increase or decrease in the number of small school districts. The study also compared the following groups of Missouri school districts:

(1) Twenty school districts in Missouri selected for the purpose of visitation.

(2) The ninety-five small school districts with total enrollments of not more than 200 pupils.

(3) The school districts in Missouri maintaining high schools exclusive of Kansas City and St. Louis.

(4) All the school districts in Missouri maintaining high schools exclusive of Kansas City, St. Louis, and the "ninety-five small school districts."

The above listed groups of Missouri school districts were compared on the following items:

(1) Average receipts.

(2) Average disbursements.

(3) Cost per pupil.

(4) Assessed valuation, levies, indebtedness, and value of school properties.

(5) The high school program.

(6) Non-resident pupils.

(7) High school graduates entering college.

(8) Training and salary of teachers.

The study also sought to compare the services of certain school systems by means of a check list applied by the writer in a personal visit to each of "twenty school districts." The check list included the following major services:

(1) Administration.

(2) Teachers.

(3) Pupils.

(4) Curriculum.

(5) Instructional equipment and supplies.

(6) Public relations.

(7) Buildings and grounds.

(8) Finance.

Summary:

(1) A trend toward high schools with larger enrollments was established.

(2) In 1953-54, the school districts in Missouri maintaining high schools with enrollments of less than 200 on the average received $43,741 and disbursed $37,623 at an average total current cost per pupil of $282.50 based on average daily attendance.

(3) In 1953-54, all school districts in Missouri maintaining high schools exclusive of Kansas City and St. Louis on the average received $228,072 and disbursed $142,297 at an average total current cost per pupil of $247.01 based on average daily attendance.

(4) The scope of the curriculum, and the curriculum organization were judged inadequate in approximately three-fourths of the "twenty school districts."

(5) The school grounds were judged inadequate in all "twenty school districts."

(6) Budgeting procedures were judged inadequate in eighteen of the "twenty school districts."

Conclusions:

(1) The small school districts in Missouri maintaining high schools are paying a higher cost per pupil for a lower quantity and quality of educational services than are the total number of school districts maintaining high schools in Missouri exclusive of Kansas City and St. Louis.

(2) The continued operation of these small school districts cannot be justified, except in cases of isolation or in other clearly justifiable cases.

(3) The "ninety-five small school districts" in Missouri with total enrollments of 200 or fewer pupils do not have sufficient income to provide adequately the educational services as defined by leading laymen and professional workers.

224 pages. $2.80. Mic 56-756

GUIDING PRINCIPLES FOR CONSTITUTING THE OHIO STATE BOARD OF EDUCATION

(Publication No. 15,836)

Albion Vernon Gotaas, Ph.D.
The Ohio State University, 1955

THE PROBLEM

In November, 1953, the voters of Ohio approved an amendment to the constitution which provided for a state board of education. Details such as the method of selecting members, size of the board, term of office, compensation, and qualifications of members, causes of dismissal, and filling of vacancies were left to the legislature. The purpose of this study was to develop principles for legislation which would be required for implementing the constitutional amendment. These principles are expressed in terms of recommendations.

SOURCES OF DATA

Recommended practices were determined by a survey of the literature in the area of state-school administration, an investigation of related studies pertaining to the composition of state boards, a study of fourteen recent statewide educational surveys, and an analysis of questionnaire responses submitted by chief state school officers and members of state boards of education.

PRINCIPAL FINDINGS

Most authorities do not believe there is one best method for selecting a state board of education. In general, they agree that there should be no ex officio members. The great weight of opinion, as revealed by sources investigated by the writer, favors gubernatorial appointment of board members.

The chief state school officer should be the executive officer of the board but not a member of it.

The state board should be large enough to represent various sections of the state and small enough to function effectively. Boards of seven and nine members were suggested most frequently.

The term of office for state board members should overlap and be long enough to develop a continuous long-range educational program. Chief state school officers and state board members expressed a preference for terms of six years or longer. Other sources of information were less specific and frequently mentioned "long" terms.

Most writers favored reimbursement for expenses only. However, a majority of the state board members and chief state school officers favored some remuneration in addition to expenses. Compensation should not be such that of itself it attracts people to serve on the state board. A per diem of fifteen dollars was mentioned frequently.

The governor should have a rather free hand in selecting board members. Some writers favored a check on the governor's authority such as confirmation by the senate. Others thought that various geographical areas as well as both sexes should be represented on the board.

Very few writers treated the dismissal aspect. Lack of attendance and misconduct were mentioned frequently by chief state school officers and members of state boards as causes for dismissal. The majority of the sources indicated that dismissal authority should rest with the governor. A few people wanted the governor's action confirmed by the senate.

Strong agreement indicated that the governor should appoint members to fill vacancies which occur on the state board.

RECOMMENDATIONS

1. The Ohio State Board of Education should be appointed by the governor.
2. Nine members should be appointed, not more than five belonging to the same political party.
3. Various geographical areas as well as both sexes should be represented.
4. Members should serve overlapping terms nine years in length.
5. The chief state school officer should be the executive officer of the board but not a member of it.
6. In addition to expenses members should be paid a per diem of fifteen dollars for not more than twelve days in any calendar year.
7. Authority for dismissing board members should be vested in the governor but confirmation by the senate should be required.
8. The same procedure should be used for filling vacancies as is used for regular appointments.

191 pages. $2.39. Mic 56-757

AN ANALYSIS OF ADMINISTRATIVE PRACTICES OF PRIVATE BUSINESS COLLEGES IN THE UNITED STATES

(Publication No. 15,546)

Ralph Frank Harwood, Ed.D.
New York University, 1955

The Problem

The purpose of this study is to determine the nature and effectiveness of current administrative practices of private business colleges in the United States. It is hoped that administrators will use these findings of relative status and criteria for measuring their practices. Investigated practices include: Program, faculty, physical facilities, finance, promotion, admission, counseling, records, graduation, and complementary services.

Procedure

A random sample of 400 schools, representing all regions of the United States, was selected to participate in the study. Questionnaires, school catalogs and promotional literature, and student record forms from 99 colleges provided the basic data. Supplementary information came from questionnaires to state education departments, high schools, and colleges in communities of participating business colleges. Sample adequacy was checked through null hypothesis techniques. Personal visits to 31 schools were made for validation purposes.

Formulated statements for administrative practices became criteria when majority-approved by a twelve-member jury of recognized business college leaders.

Effectiveness of administrative practices was measured by the percentages of replies meeting each related criterion, criteria for each subsection of practices, and criteria for entire administrative areas.

Findings and Conclusions

The business colleges meet most of the approved criteria. Ninety-four per cent of the administrative practices relating to complementary services meet the criteria; 89 per cent of program practices meet the criteria; and 73 per cent of faculty personnel practices meet related criteria. In lesser proportions, by percentages indicated, other practices meet approved criteria: Finance and promotion, 68 per cent; physical facilities, 61 per cent; admission, counseling, and records, 58 per cent; and graduation, 50 per cent. Major weaknesses, as measured by criteria, are found in subsections of personnel practices. Only seven per cent of salary practices and 37 per cent of in-service professional improvement practices meet their criterion. Other deficiencies, as proportions of practices meeting criteria, include: Advertising costs, 28 per cent; library facilities, 43 per cent; admission practices, 49 per cent; refund practices, 59 per cent; and personality development, 60 per cent. Other findings: Tuition rates have risen less than the Consumer Price Index, from 1938 to 1953; accounting practices vary among business colleges.

Program practices indicate recognition of basic training responsibilities, and business college administrators seem conscious of a need to render more than educational services to their communities.

Administrators are raising standards for professional qualifications of teachers despite relatively unattractive salary ranges and limited provisions for in-service professional development.

Financial administration indicates clear-cut pricing practices, but tends to be indifferent toward stated refund provisions. Advertising costs may not be within the range specified by the approved criterion, but content of audited advertising is on an ethical plane.

Suitability and variety of equipment in these schools reflect general acceptance of skill training as a primary responsibility. In contrast, limited library provisions seem indicative of the relatively minor responsibility accepted for general education.

Recommendations

Business colleges should raise salary ranges to competitive levels with other educational agencies, and provide more extensive in-service professional development programs for teachers. They should raise tuition; place more exacting management controls on income and expenses; and have stated refund practices. Further recommendations are to tighten admission procedures; expand educational services through more adequate library provisions and through more attention to personality development.

Research recommendations include: An investigation to determine appropriate accounting practices for business colleges; an organizational means to gather pertinent data at relatively frequent intervals; a study of the economic or social worth of business colleges: a survey of average initial weekly salaries of business college graduates and monthly tuition charged in their communities; and the development of a standardized means to measure administrative practices. 152 pages. $1.90. Mic 56-758

AN IDENTIFICATION AND APPRAISAL OF BOARD OF EDUCATION POLICIES IN THE NORTHWEST AND SELECTED URBAN AREAS IN THE UNITED STATES

(Publication No. 15,711)

Kenneth Paul Mallery, Ed.D.
University of Washington, 1955

Supervisor: Dr. George D. Strayer, Jr.

Purposes of the Study

Two purposes were basic to the study: (1) to identify and appraise school board policies in the Northwest and selected urban areas; (2) to define a minimum set of policies for school districts of various enrollments.

Procedures

The literature was reviewed concerning the following areas: (1) legal considerations of school board policies as a transmittal of power; (2) theory and practice of school board policies; (3) method of developing school board policies; (4) codification of policies.

Investigations to serve the stated purposes were conducted as follows: (1) thirty-six policy pamphlets from large and small school districts were examined for style and content; (2) opinions concerning permissive areas for board of education policy development were sought from the attorney generals of Washington, Oregon, Idaho and Montana; (3) forty-two superintendents of large and small school districts and one official of a state teachers' organization were interviewed; (4) questionnaires concerning policy style, policy content, and policy areas were sent to 498 superintendents in Washington, Oregon, Idaho and Montana, and in selected urban areas in other parts of the United States. Each communication carried two questionnaires to be completed, one for the superintendent and one for the president of the board of education.

Literature

The transmittal of power through constitutions and state legislatures to local boards of education is clearly stated in the literature; however, the transmittal of power from boards of education to superintendents of schools through policy formation is not extensively explained. Although theory concerning development of school board policies is favorable and insistent, the practice of policy development among boards of education in the United States is not general.

Investigation

The majority of the policy pamphlets examined were not indexed or codified, were mimeographed and lacked visual appeal. Dates of adoption, legal appraisal, and revision of policies were not evident in the majority of the policies examined. Differentiation of policies and rules and regulation was not evident in the majority of the policy pamphlets examined.

Attorney generals' offices of Oregon, Montana and Washington co-operated in stating permissive areas of legislation for policy formation. Policy areas ranked from highest to lowest in permissive legislation in the three states are as follows: (1) policies relative to the use of buildings; (2) policies relative to students; (3) policies relative to miscellaneous items; (4) policies relative to the administrative staff; (5) policies relative to the instructional staff; (6) policies relative to the non-instructional staff; (7) policies relative to the board of education.

Superintendents interviewed did not favor compulsory state legislation in the areas of policy development. Superintendents, when limited to a choice of five policy areas, chose the following: (1) personnel policies (certified and non-certified); (2) policies governing the meeting and action of the board of education; (3) student personnel policies; (4) use of school buildings; (5) selection of the superintendent who would select personnel.

The majority of superintendents and board members replying to the questionnaire operated under policies and mimeographed policies for the employees. General circulation of policies was not extensive. Superintendents and board members agreed that the superintendent should operate under policies. Legal advice was used infrequently by boards of education in policy development. A system of reviewing and revising policies was not widely used. Slight use was made of the lay public in developing policies according to the replies.

Interest in the broad areas of policy development was maintained at the 50 per cent level or above as follows: (1) use of buildings and grounds (82 per cent level); (2) policies relative to the non-instructional staff (66 per cent level); (3) policies relative to the instructional staff (65 per cent level); (4) policies relative to the board of education (63 per cent level); (5) policies relative to the students (61 per cent level); (6) policies relative to miscellaneous items (50 per cent level).

Superintendents and board members believed at the 70 per cent level that efficiency was gained in operating under policies in the following categories: (1) board resists pressure groups; (2) board makes greater effort to understand its own functions, duties and responsibilities; (3) board members have a better understanding of the purposes and objectives of the modern school; (4) operating

under policies tends to save time in introducing new board members. 304 pages. $3.80. Mic 56-759

SELECTION AND MANAGEMENT OF INDUSTRIAL ARTS EQUIPMENT IN THE SECONDARY SCHOOLS OF MISSOURI

(Publication No. 14,950)

Ross J. McArthur, Ed.D.
University of Missouri, 1955

Major Adviser: H. H. London

Purpose of Study: To ascertain what major equipment is found in industrial arts shops in Missouri, the current practices used in equipping and maintaining adequately equipped shops in the state, and how these practices compare with practices and procedures recommended by a selected group of specialists in the field.

Method of Research: Information regarding practices and procedures used was obtained through information forms submitted to industrial arts teachers in the state and to superintendents with industrial arts teachers on their staffs. This information was compared with opinions of selected teacher trainers throughout the United States, concerning preferred or desirable practices, obtained through information forms submitted to them.

Summary: The chief findings of the study are as follows:

The most important factors in selection of equipment were safety features, educational value, and quality.

The majority of teachers and specialists preferred medium weight equipment, with Delta, Atlas, and Walker-Turner being most commonly reported.

The most common size of major equipment was often smaller than the most preferred size suggested by specialists.

More equipment was considered essential for unit shops than for general shops.

Out-state industrial arts facilities were reported by many teachers as being used somewhat less than full time with a relatively small class size.

Few teachers reported a fixed budget for either new equipment or maintenance of present equipment, although specialists favored such a budget, especially for new equipment.

The average estimated replacement value of all equipment reported by out-state teachers was $4,097, while that reported by Kansas City and St. Louis teachers was $10,839.

Spring was reported as being the best time for ordering equipment.

Safety was by far the most important factor considered in installation of equipment, with three dimensional models being the most preferred planning procedure, although not the most often used.

Teachers generally indicated little by way of attempts at noise, vibration and dust abatement, whereas specialists suggested use of cushion mountings and use of an exhaust system.

A large percentage of equipment was reported in fair or poor condition with drawing tables, woodwork benches, and metalwork benches being notably so classified.

Metalworking equipment was generally reported as least used and also in poorer condition.

The majority of teachers did not allot specific time for maintenance of equipment nor did they include it as a phase of the instructional program to the extent specialists thought they should. Specialists indicated that slightly more than 4 hours per week should normally be alloted for maintenance work.

The majority of schools used their industrial arts equipment for upkeep of the school plant, although specialists considered this undesirable. Superintendents and specialists agreed that only competent and reliable persons should use equipment and it should not interfere with the instructional program.

Teachers generally used a brief sheet form of inventory, whereas specialists preferred a card index system with more detailed information.

Replacement practices regarding industrial arts equipment were rather indefinite in the minds of both administrators and teachers, with specialists favoring more consideration of obsolescent factors.

Conclusions: A shortage of funds for equipment often leads to poor selection or loss of sight of the real values derived from industrial arts activities.

Many small schools can only expect to justify further expenditure of funds for equipment through increased enrollment or increased use of facilities by other groups. Controlled use of the equipment for upkeep of the school plant may be justified.

Installation of equipment is often relatively simple, hence planning is considered of much less importance than it actually should be.

Teacher training institutions are not placing enough emphasis on equipment maintenance and inventory.

Generally speaking, the practices and procedures used in procuring and managing industrial arts equipment compare favorably with the practices and procedures recommended by specialists in the field.

242 pages. $3.03. Mic 56-760

LEGAL RIGHTS, PRIVILEGES, AND RESPONSIBILITIES OF PUPILS IN THE PUBLIC SCHOOLS OF ILLINOIS

(Publication No. 15,727)

Oren David McClure, Ed.D.
Washington University, 1955

Chairman: Dr. Stephen C. Gribble

This study is a synthesis of the legal rights, privileges, and responsibilities of pupils in the public schools of Illinois. Source material includes United States Supreme and District Court decisions, Illinois Supreme and Appellate Court decisions, Illinois statutory law, opinions of Attorney Generals of Illinois, and opinions of the Legal Adviser to the Illinois Superintendent of Public Instruction.

The following areas have been extensively treated: legal foundations, special services, health and safety, legal bases concerning curriculum, legal bases for pupil control, eligibility regulations, and miscellaneous matters pertinent to the title.

The legal roots of the public schools in Illinois are found in the Constitution of 1870. Since public schools serve a societal purpose, pupils are with certain exceptions required to attend school until they are sixteen years old. A pupil may receive his education in a private, a parochial, or a public school or even in his own home if the educational features are comparable. All pupils have a right to a common school education, including high school, regardless of race or class if they meet eligibility requirements.

The area of special services especially reflects the changing philosophy of the society from which the public schools stem. Transportation rights are conditional upon such things as the distance the pupil lives from school, the kind of district wherein he lives, whether the pupil lives outside the district, and the availability of public transportation. Attendance in special education classes is a privilege instead of a right.

Evidence is presented which shows that the courts may be gradually changing their attitude toward the exemption of the school from tort liability. Since clean, healthful, safe, and beautiful school buildings and grounds have a positive effect upon boys and girls, they are included among the rights of pupils. Public health laws support the rights of pupils regarding the spread of communicable disease.

Some subjects are mandatory, but for the most part the determination of subjects to be taught is made by the school board and voters of each district. Since parents have a right to direct the education of their children, the individual pupil need not take all subjects. Bible reading in the public schools of Illinois is considered sectarian and therefore illegal. Textbooks may be rented, furnished free, or purchased by the pupil depending upon decisions by the voters or by the school board.

Ordinarily the courts do not interfere in school discipline as long as school officials act in a reasonable manner and have reasonable rules and regulations. The question as to the reasonableness of rules and regulations is one for the courts to answer. Reasonable punishment, corporal or otherwise, may legally be administered by the teacher if such is done without malice, with restraint, and in good faith.

Pupils who have been graduated from an elementary parochial or private school have a right to attend a public high school without taking an entrance examination. Segregation may not legally be practiced in Illinois.

Pupils may not legally receive religious instruction on school premises during school time; they may receive such instruction off school premises during school time. Pupils under sixteen years of age may not legally be employed during school hours.

Schools are operated for a societal and State benefit as well as for the benefit of boys and girls. Pupils' rights have been given to them by the State Constitution, the General Assembly, State officials, and school boards; these rights can also be taken away from pupils for sufficient reason.

215 pages. $2.69. Mic 56-761

TURNOVER AND TRAINING OF MISSOURI SUPERINTENDENTS OF SCHOOLS

(Publication No. 14,951)

Raymond Clark Morton, Ed.D.
University of Missouri, 1955

Major Adviser: W. W. Carpenter

Purpose:

To investigate the turnover of superintendents of schools in Missouri; the cause or causes of turnover during the ten-year period 1945-1955; and the graduate training of superintendents of schools in 1954-1955.

Method of Research:

This was a normative-survey study. The data were obtained chiefly from official records at the Admissions Office of the University of Missouri; the Missouri School Directory; an information blank concerning the cause or causes for turnover; and an information blank concerning the total graduate training of superintendents of schools who served in Missouri in 1954-1955.

Summary:

1. Among the 1,386 persons employed in Missouri as superintendents of schools during the period 1945-1955, 584 were superintendents in 1954-1955 and 802 had left the superintendency.
2. The 584 superintendents of schools in Missouri in 1954-1955 had served a median of eight and six-tenths years, which represented an increase in retention when compared to the groups studied in 1938 and 1943, but a decrease when compared with the group studied in 1953.
3. School systems in Missouri that employed fifteen or fewer teachers accounted for eighty-two (or 68.3 per cent) of the 120 changes made in superintendencies in 1954-1955. Sixty-two of these were entrants and fifty-eight were transferees.
4. The 584 superintendents of schools in 1954-1955 had been employed in 1,077 different superintendencies during the period 1945-1955. Five hundred thirty-one of these superintendencies (or 49.3 per cent) were in school systems that had a total enrollment of 300 or fewer pupils.
5. Of the 332 superintendents who withdrew and who responded, 210 (or 63.3 per cent) rendered educational service in some capacity in 1954-1955.
6. A median of thirty-nine and one-tenth graduate hours had been completed by the 310 superintendents who withdrew and who replied.
7. "Inadequate salary" was the item considered most discouraging about school administration in Missouri. "Uncertain tenure," "community pressures," and "administrative pressures" were the next three most discouraging items.
8. The 480 superintendents of schools in 1954-1955 who returned the Information Blanks had attended fifty different colleges for graduate credit. The four colleges most often attended other than the University

of Missouri were Northeast Missouri State Teachers College, Washington University, University of Kansas City, and Central Missouri State College.

9. The median graduate hours earned by superintendents of schools, who had attended the University of Missouri, increased from a low of twenty-six and four-tenths graduate hours of credit in 1938 to thirty-four and one-tenth graduate hours of credit in 1955.

10. Four hundred twenty Missouri superintendents of schools in 1954-1955 had completed more than thirty-two graduate hours, and eighty-nine superintendents had earned fifty-seven or more graduate hours of credit.

Conclusions:

1. In general, the length of superintendency in Missouri was longer for former superintendents in the larger school systems than in the smaller school systems.

2. For the most part, there was a higher turnover in Missouri of former superintendents in the smaller school systems than in the larger school systems.

3. The local school levy did not have any appreciable effect on the turnover of superintendents of schools.

4. Generally, the superintendents of schools who dropped out during the ten-year period 1945-1955 were as well trained professionally as the active superintendents employed in 1954-1955.

5. The Missouri superintendents of schools were generally better trained in 1954-1955 than in 1938, 1943, or 1953.

6. Former superintendents who left the profession in the period 1945-1955 were somewhat better prepared professionally than those who remained in the profession. 276 pages. $3.45. Mic 56-762

THE ROLE OF THE SCHOOL SUPERINTENDENT'S WIFE

(Publication No. 15,873)

Vergil Kenneth Ort, Ph.D.
The Ohio State University, 1955

The purpose of the study was to develop a set of characteristics to be considered as a basis of personal decorum by those whose role is that of school superintendent's wife and which it would also be desirable for boards of education to consider when investigating or interviewing a prospective school superintendent's wife.

This study was limited to the following areas: first, the characteristics which some school superintendents, presidents of boards of education, superintendents' wives, and laymen in Ohio consider desirable for the wife of a school superintendent to have; second, suggestions gathered concerning the best method or methods to use in interviewing a prospective school superintendent's wife.

Sixteen characteristics pertaining to a school superintendent's wife were formulated and set up on an inquiry sheet. These characteristics were rated by some school superintendents, presidents of boards of education, superintendents' wives, and laymen in Ohio. Comments pertaining to these characteristics were collected from the inquiry sheets as well as from personal interviews. Additional desirable characteristics were also collected, as were some undesirable ones.

The literature was reviewed which pertained to the role that wives have played in history as this role relates to man and his works. This body of material indicated that even though the position of the wife in society has been an inferior one, the wife's influence has been great, and her place in our social culture today is greater than ever before.

On the basis of the research conducted, the following characteristics pertaining to the role of the school superintendent's wife appear to be of great importance:

--she should be intelligent, well educated, adaptable, sociable, a good listener, interested in her husband's work, and willing to play her role behind the scenes.

--she should be a model homemaker, a church member, and a member of some civic organizations.

--she should maintain a balanced budget, dress well but not pretentiously, keep her home and family presentable, and be adaptable to change.

--she should know the limits beyond which she cannot go in giving help to her husband, and she should not divulge confidential information.

--she should seek no special favors for herself or her children because she is the superintendent's wife.

--she should have no special cliques beyond her close personal friends.

--she should have a sense of humor; be receptive of criticism; be a model of efficiency, patience, and charm; be coöperative in providing a wholesome and balanced life of work, rest, and relaxation; and have a love of children, a respect for humanity, and faith in her husband.

--she should live a normal life based upon her interests, talents, time, and education in so far as these do not conflict with the mores of the community in which she lives.

--she should be one who avoids being a "gossip," an overly aggressive or dominating person, a social climber, or one who acts superior.

--she should have good mental, emotional, and physical health.

How she plays her role as a wife of a school superintendent is affected by the size of the city or the community in which she lives, for more demands are made and a more critical attitude prevails in cities under 10,000 population.

School board members believe the wife of a prospective school superintendent should be visited in her home by a committee of school board members before her husband is appointed to a new position.

273 pages. $3.41. Mic 56-763

PRESENT AND FUTURE SCHOOL PLANT NEEDS FOR THE SALEM, NEW HAMPSHIRE, SCHOOL DISTRICT

(Publication No. 13,653)

Jonathan A. Osgood, Ed.D.
New York University, 1955

Chairman: Professor Walter A. Anderson

The purpose of this study was to determine the immediate and long-term public school plant needs of the Salem School District. Research was conducted by the writer who placed major dependence upon data obtained directly from a school and family census of Salem. Other data were from local and state statistics and from materials prepared by recognized authorities.

To receive the benefits of community opinion and to make the community more conscious of present conditions and future needs, the investigator prepared the study in cooperation with the Salem School Survey and Building Committee, composed of nine local citizens. The committee made a comprehensive study of results of the school and family census; capacity and condition of present school buildings; financial condition of the town and school district, and the past, present, and predicted enrollments.

Salem is one of the most rapidly growing communities in the state, and practically all Salem children attend the public schools. All factors, especially migration, indicate continued growth. Based on maximum standards of thirty pupils per room, there is a shortage of five classrooms and many special service facilities. Estimates indicate a continued increase from the present enrollment of 1224 to 1734 in 1960, and 2292 by 1970.

The professional employees in Salem are working toward modern educational objectives as plant facilities permit. Minimum curriculum offerings and limited physical facilities have been acceptable during past years. Although existing buildings are well located geographically, several of them are too small. By use of building score cards, two of the buildings were classified as poor and five as fair. The Central School, which houses forty per cent of the 1224 pupils, was scored as excellent.

Salem is a relatively poor community in terms of valuation of property. The debt history is clear of default, and tax collections are practically one hundred per cent. The maximum borrowing capacity is $244,000. In adjusted valuation per pupil, Salem is third from the lowest in comparison with twelve other selected districts in New Hampshire, and nearly $5,000 lower than the state average. The school tax rate is higher than that of any other selected district, and $14 higher than the state average. Salem spends less per pupil and offers fewer educational services than most New Hampshire districts.

Although property is underassessed, Salem is faced with a great discrepance between plant requirements and the financial ability to provide them. While all plant units will necessarily be used, the No. 4 and No. 6 Schools should be abandoned as soon as possible. Relatively inexpensive but important improvements in the older plant units should be made. Eighteen additional classrooms will be needed by 1960, ten more by 1965, and a total of thirty-eight by 1970. These numbers do not include special rooms.

After completion of the six-room school at Salem Center, an addition to the Woodbury High School should be constructed immediately to provide shop instruction and additional science facilities.

A twelve-room elementary school should be constructed in the No. 6 area by 1957, making possible the abandonment of the No. 4, No. 6 and No. 8 Schools; a fifteen-room junior high school building should be constructed in the vicinity of the Woodbury High School by 1960.

Without financial assistance, it will be several years before Salem can provide a suitable school plant.

206 pages. $2.58. Mic 56-764

A STUDY OF CERTAIN CURRENT WASHINGTON STATE SCHOOL DISTRICT PERSONNEL POLICIES AND THEIR ADMINISTRATION

(Publication No. 15,714)

Rufus Coleman Salyer, Jr., Ph.D.
University of Washington, 1955

Supervisor: Dr. George D. Strayer, Jr.

Purpose

The purposes for this study were to investigate administrative procedures and devices used in the selection and appointment of personnel for teaching positions and principalships, and administrative procedures for evaluating the work of the classroom teacher in the public schools.

Method

The data were collected by means of questionnaires sent to the administrative heads of 318 Washington school districts and twenty-four districts in Oregon, Idaho, and Montana. Two hundred thirty-three (68.1 per cent) completed questionnaires were returned.

Conclusions

Teacher selection. 1. The administrative heads of school districts were responsible for the selection of teachers subject to appointment by the boards of education. In only the smaller districts did members of the boards of education participate in the selection process.

2. Inexperienced teachers were employed in nearly all districts.

3. Married women were eligible for appointment to full-time regular positions in practically all districts, however, over one-fourth preferred single women over equally competent married women.

4. The residence of the candidate was not an important factor.

5. University and college placement services were the most universally used sources, and the most productive, for locating candidates. The next most productive source was the direct application of candidates.

6. Direct applications were welcomed by a large majority of districts even though no vacancy might exist.

7. University and college placement bureau credentials were required of candidates by a large majority of districts. The rest preferred to have credentials.

8. A personal interview was required in over half of

the districts. The rest preferred to have personal interviews with candidates but occasionally employed a candidate without.

9. Written examinations were not required of applicants in any districts surveyed.

10. Interviews were conducted generally by both the superintendent and the principal.

11. Twenty minutes was designated as the optimum period for placement bureau screening interviews.

12. The principal objectives of the personal interview were to appraise the candidate's personality, voice, and physical characteristics. Information concerning dependents, use of leisure time, marriage plans, college grade point average, and per cent of expenses earned while in college was seldom sought in the interview.

Teacher evaluation. 1. The principal objective reported for the evaluation of teaching was to improve instruction. Only in rare cases did evaluation result in deviation from the salary schedule of the district. Extra-class responsibilities which carried additional remuneration were assigned in many districts on the bases of teacher appraisal.

2. Evaluation procedures were informal and followed no set plan in most districts. In general, appraisal procedures were determined without participation of classroom teachers.

3. In most districts instruction was evaluated during classroom visits which were being made primarily for administrative purposes, although many administrators visited classrooms primarily for appraisal of instruction.

4. Evaluation reports of teachers were most commonly submitted in writing to the central office when such reports appeared desirable — not at periodic intervals.

5. Comments of colleagues, parents, and pupils were considered informally, by many administrators, in teacher evaluation.

6. Teachers were advised of the contents of evaluation reports on their work in less than half of the districts.

7. A majority of the administrators believed that merit in classroom instruction should be rewarded financially. Nearly half believed that such a procedure was impractical.

Principal selection. 1. The majority of districts listed principalship vacancies with university and college placement offices.

2. In half of the districts local staff members were given preference and if qualified no outside applicants were considered. In the remaining districts qualified local staff members were considered along with out-of-district applicants.

3. Women were considered rarely for principalships in secondary schools. They were considered for elementary principalships in one-third of the districts.

4. School board members interviewed candidates at some stage in the selection process in half of the districts.

5. More than three-fourths of the respondents believed that the University of Washington should train prospective principals through a program including an internship experience. 196 pages. $2.45. Mic 56-765

EDUCATIONAL CHANGES IN PENNSYLVANIA THROUGH LEGISLATION AND ADMINISTRATIVE INTERPRETATIONS 1929-1954

(Publication No. 15,475)

John Beryl Springer, Ed.D.
George Peabody College for Teachers, 1955

Major Professor: Willard E. Goslin

The purpose of this study is to show how educational change was brought about in Pennsylvania through legislation and administrative interpretations during the period 1929-1954. Some of the ways Pennsylvania has tried to provide an adequate educational program to meet changing economic, political, and social conditions are described.

Plan of Procedure

This study is presented in narrative form. The historical method of research is used. The Pennsylvania School Laws and State Department of Public Instruction publications provided the major sources of data for the study. Additional sources of information were the Constitutions of Pennsylvania, The Laws of Pennsylvania, Pennsylvania School Journals, and selected reference books on Pennsylvania history and education.

The study is presented in two parts. Part I contains background materials related to the study. Part II is concerned with selected Pennsylvania legislation and administrative interpretations effecting change in the areas of (1) state level organization for education; (2) school districts, school directors; (3) school finances; (4) buildings, grounds, equipment, supplies; (5) administration, supervision; (6) the teacher; (7) the pupil; (8) school organization, courses of study; (9) vocational education; and (10) miscellaneous legislation.

Summary of Findings

The Pennsylvania Department of Public Instruction and the State Superintendent of Public Instruction became increasingly important in the educational affairs of the State during the period 1929-1954. The scope of activities of the Department increased and departmental reorganization was effected on numerous occasions to meet the educational needs of the State. The Superintendent through his reports and recommendations to the Governor, the Legislature, and the people did much to advance public education in Pennsylvania.

The State Council of Education established standards and regulations regarding school buildings, teacher qualifications, and school buses, among other things. These standards were reviewed and revised to meet changing needs.

State support for public education steadily increased between 1929 and 1954. At the close of 1954 approximately half of the state budget was concerned with education. A State Tax Equalization Board was created to determine a more equitable distribution of state funds to local districts. A State Public School Building Authority was created to assist local districts in meeting classroom needs.

The welfare of the teacher was cared for through tenure, sabbatical leave, sick leave, and retirement improvements. In addition, teacher salaries were raised on several occasions.

During the period under study, a minimum school term of 180 days was established. Pupil health and welfare services were extended and improved. Courses of study were revised to meet more adequately the needs of the pupils.

Conclusions

1. Educational legislation reflected economic, political, and social conditions.
2. Much Pennsylvania educational legislation was general in nature.
3. The Department of Public Instruction, the State Superintendent, and the State Council of Education became increasingly important in the development of education in Pennsylvania.
4. District reorganization and school consolidation need to be extended.
5. As state funds for education have increased, local effort has decreased.
6. Local property assessment methods need revision.
7. Teacher welfare benefits have been numerous, but extensions are necessary.
8. Local districts need more state help in school building construction.
9. The School Health Act of 1945 was important in improving pupil welfare services.
10. The success of the state educational program depends on the wisdom with which laws are interpreted and administered.
11. It is anticipated that state expenditures, state influence, and state services for education in Pennsylvania will increase. 418 pages. $5.23. Mic 56-766

ANALYSIS OF SOME OF THE ADMINISTRATIVE PROBLEMS IN THE SCHOOL DISTRICTS OF OTHELLO, CONNELL AND WARDEN

(Publication No. 15,661)

W. Del Walker, Ed.D.
State College of Washington, 1955

The school districts of Othello, Connell and Warden in the Columbia Basin area of Washington face unusual school finance and organization problems. The delivery of water to this once arid region is causing a tremendous growth in population. The resulting increase in numbers of children between now and 1961 will necessitate large expenditures for added school facilities.

The purpose of this study was to project and determine the relationship between the school-age population and the assessed valuation, as they relate to the ability of the school districts of Othello, Connell, and Warden to provide for needed building facilities and to maintain a school program which is financially equivalent to that now provided.

The method used in the study was to collect and analyze data; to project school-age population as it related to farm unit development; to project assessed valuation as it relates to farm unit development; to project assessed valuation as it relates to school-age population growth; to estimate the near future financial ability of the selected school districts to provide needed buildings; and to determine if the selected districts can maintain a program financially equivalent to that which they now have.

The rural school-age population projection was based upon two studies. The first study estimated the school-age population to be one school child per farm unit. The second estimated the school-age children per farm unit to be three-tenths. From the data provided by these two studies, high and low projections of school-age population were made.

To project urban school-age population the rates of rural residents to urban residents was four to five.

The second phase of the study was based upon the ratio of assessed valuation to school-age population in eight comparable school districts which has been developed for a period of years.

The third phase of the study related financial ability to estimated building needs.

The fourth phase of the study compared financial ability per pupil to maintain programs in 1951 to estimated financial ability per pupil to maintain programs in 1961.

The analysis of some of the administrative problems of the school districts of Othello, Connell, and Warden was based on the assumption that if the number of farm units that would receive water for irrigation purposes could be determined, many school administrative problems could be identified and analyzed well ahead of the time they became critical.

The increase in school-age population, number of teachers and classrooms needed by 1961 are indicated in the study. The relationship of the growth in school-age population to the increase in assessed valuation was determined. The estimated assessed valuation was analyzed to determine the amount of money that could be raised for building facilities and to maintain an educational program. It may be further concluded from the study that during the period of development sufficient monies to provide adequate classrooms and programs will not be available at the time needed, but at the time that all properties have been placed on the tax rolls and yielding revenue the selected districts will financially be in a position to provide needed building facilities.

It is hoped that this study will be of assistance in pointing up the educational problems the school districts of Othello, Connell and Warden face and suggests that through a continuous study it may be possible for these school districts to make long-range plans that will help them to meet better the needs as they arise. Planning should be continuous, and the plans should continually be revised in light of new and more exact information provided by actual conditions. 121 pages. $1.51. Mic 56-767

EDUCATION, ADULT

FACTORS RELATING TO THE FINANCIAL SUPPORT OF CONTINUING EDUCATION AS REVEALED BY A STUDY OF SELECTED MICHIGAN COMMUNITIES

(Publication No. 15,844)

John Bernard Holden, Ph.D.
The Ohio State University, 1955

Statement of the Problem

The primary purpose of this study was to determine to what extent citizens in certain selected Michigan communities subscribe to the value of adult education, who respondents would say should support financially specific types of adult education activities, how much respondents who showed an interest in a specific kind of adult education indicated they personally would pay to participate, what factors, if any, relating to financial support of adult education would condition the opinions of respondents.

Procedure

Three different-sized communities were selected. The study was based on the selection of a random sample of the adult population of each community. Volunteer lay leaders and graduate students were trained and used as interviewers. The results were tabulated by cities, combined for analysis of major variables, and tested for significant differences by the use of χ^2.

Results

People will as individuals:

1. Pay more readily for adult education which will increase their earning ability than for some other types.
2. Pay to a considerable degree for adult education that will provide self-satisfaction of a recreational or cultural nature.
3. Be more reluctant to pay for adult education that improves the home and community than for other types.
4. Pay a part of the cost of certain types of adult education, but not all of the cost. People were more willing to support civic and public affairs education by taxes than any of the other five types; adult education for earning a living was second; home and family education, third; intellectual development, fourth; and recreational skills, last.
5. Be influenced somewhat in their willingness to pay for adult education by the number of years of school completed, family status, family income, and the number of organizations with which they are affiliated. Very little relationship was found between sex, age, church affiliation, occupation, and socio-economic class and people's views about financing adult education.

Recommendations

1. Every public school district should make adequate budgetary provisions for general adult education. This can be done by joining with other school districts when necessary.
2. Minimum expenses to be borne by boards of education should include building overhead and supervision.
3. Boards of education should conduct courses within their unique competencies, including basic skills and opportunities in the areas of home and family education, civic and public affairs, and intellectual and cultural activities.
4. Boards of education should also provide leadership that will encourage groups and agencies to coöperate in developing educational opportunities for all adults.
5. Adult education agencies should work toward making most forms of education available to adults without cost or with fees low enough not to discourage participation.
6. The same basic principles of financing that apply to boards of education should be adopted by the state colleges and universities. The possibility of both state and federal subsidies for adult education should be explored.
7. Private institutions and group-work agencies should take primary responsibility for offering adult education activities for recreational skills, selected programs of intellectual development, and other activities for which people will pay all or a substantial part of the cost.

223 pages. $2.79. Mic 56-768

EDUCATIONAL NEEDS OF PROSPECTIVE HOME OWNERS CONCERNING THE ACQUISITION AND OWNERSHIP OF A HOUSE

(Publication No. 14,954)

Loyd Wallace VandeBerg, Ed.D.
University of Missouri, 1955

Major Adviser: H. H. London

Purpose of Study: To ascertain the educational needs of prospective home owners in the state of Washington concerning the problems involved in selecting, purchasing, constructing, and maintaining and repairing a house.

Sources of Data: Data were obtained via printed information forms from 424 home owners and 76 specialists in the state of Washington. The specialist group was composed of architects, real estate dealers, and building contractors. These data were tabulated, per cent of response for each item was computed, and opinions of respondents relative to educational needs of prospective home owners, desire of respondents for an opportunity to learn the facts they recommended as needs for prospective home owners, acquisition and home ownership experiences of the respondents, and recommendations of respondents concerning desired curricular inclusions for their communities appear in tabular form in this report.

Summary and Conclusions: Home owners and specialists were in close agreement in their opinions concerning items of information needed by prospective home owners. A four-fifths majority of both home owners and specialists indicated that it is important for prospective home owners to know how to select, purchase, plan and contract for, and maintain and repair a house. A 51 per cent majority of home owners expressed a desire to know more concerning these same items.

Recommendations of respondents favored a program of education for their communities. High school students, according to 66 per cent of the home owners and

63 per cent of the specialists, are ready to learn the information which the two groups believe that prospective home owners need.

Respondents, in general, placed most emphasis on needs of adults in their communities. In the opinion of 91 per cent of the home owners and 89 per cent of the specialists, instruction dealing with the selection, purchase, construction, and maintenance and repair of a house should be offered in their communities.

Prospective home owners need to know how to solve the problems involved in selecting, purchasing, constructing, and maintaining and repairing a house.

High school courses in these problems should be available for interested students. Instruction should be made available through local high school adult education programs for young adults and for adults who have been or are home owners and who feel the need for further learning concerning the problems of home acquisition and ownership.

Implications: High school administrators should revise their curriculums to include instruction dealing with problems of selection, purchase, construction, and maintenance and repair of a house. Instruction on the high school level need not be as detailed and technical as that offered for adult prospective home owners, but all high school students should have an opportunity to elect this instruction.

High school administrators should make plans to offer instruction for adults in the problems of home acquisition and ownership. Arrangements should be made to give college credit for these courses to those who desire such credit. College extension departments should prepare to cooperate with local adult education programs in organizing and teaching information concerning selection, purchase, construction, and maintenance and repair of a house.

Courses of study should be incorporated into college teacher training programs to prepare teachers for these courses. Schools teaching engineering, architecture, and business and economics need to incorporate applicable units into their training programs.

On whatever level and wherever courses are offered in the problems of home acquisition and ownership, the classroom teacher should have the cooperation and professional help of architects, real estate dealers, building contractors, lawyers, and bankers.

Courses should be offered for adults in the evening, preferably in the winter or spring seasons, and should be offered annually because the need for this type of instruction is continuous.

115 pages. $1.44. Mic 56-769

EDUCATION, AGRICULTURAL

AN EVALUATION OF SELECTED ASPECTS OF THE PRE-SERVICE CURRICULUM IN AGRICULTURAL EDUCATION AT THE ALABAMA POLYTECHNIC INSTITUTE

(Publication No. 15,807)

Zeno Earl Bailey, Ph.D.
The Ohio State University, 1955

The primary aim of the study was to determine through teacher and administrator evaluation the effectiveness of selected aspects of the pre-service curriculum in preparing teachers of vocational agriculture. A second purpose was to identify chief strengths and weaknesses of the curriculum and to determine the effect of experience and graduate training upon teachers' ratings of courses and the competency ratings of teachers by administrators.

The procedure involved (1) a critical examination of related evaluation studies and other selected literature in the field, and (2) the preparation of instruments used by (a) teachers in evaluating the effectiveness of the courses in the pre-service curriculum, and (b) administrators in evaluating teachers and their programs in terms of preparation and competence in 11 areas of the high school vocational agricultural program.

The three most valuable courses in general education were Public Speaking, Agricultural Journalism, and English Composition, while American History and Physics were believed to be least valuable in teacher preparation. Teachers recommended an average of 70.8 hours, or 9.2 hours less than the number provided in the curriculum. There was a positive relationship between ratings and experience levels of the teachers. Except for the teachers who had completed 21 - 40 hours of graduate training, a positive relationship existed between the ratings and educational levels of the teachers in 36 per cent of the courses. Sixty-one per cent of the elective courses in general education were in the Psychology Department, 20 per cent in the English Department, and 18 per cent in the History Department.

Apprentice Teaching, Directed Teaching, and Methods of Vocational Agriculture were the three most valuable professional education courses, while Educational Psychology and Principles of High School Teaching were thought to be least valuable. Teachers recommended an average of 38.8 hours, or 3.8 hours more than were provided in the curriculum for professional education. There was little or no relationship between ratings and experience levels and the educational levels of teachers. The teachers recommended an average of 10.4 weeks for apprentice teaching; 51 per cent preferred the spring quarter; 89 per cent preferred the senior year; and 73 per cent preferred to remain in the same school for the entire period of apprentice teaching.

The three most valuable technical agriculture courses were Farm Shop, Vegetable Gardening, and Orchard Management, while General Soils was considered least valuable. Teachers recommended an average of 100.6 hours, or 5.6 hours more than were provided in the curriculum for technical agriculture. A negative relationship existed in 11 of the 18 courses when ratings of the teachers who had taught 0 - 3 years and those who had taught 7 - 10 years were compared. A similar relationship existed when

the ratings by teachers with only the Bachelor's degree were compared with those with the Master's degree or its equivalent. Fifty-four per cent of the elective courses in technical agriculture were in the Animal Husbandry Department, 25 per cent in the Agricultural Economics Department, 11 per cent in the Agronomy Department, and 10 per cent in the Horticulture Department.

On the basis of the average of the item ratings in 11 areas of the program, administrators rated teacher preparation and competence as follows: (1) general school program (4.09), (2) professional relationships (3.81), (3) physical facilities (3.81), (4) classroom teaching (3.77), (5) school and community relations (3.69), (6) Future Farmers of America (3.66), (7) supervised farming program (3.63), (8) guidance and counseling (3.50), (9) long-time program (3.46), (10) program evaluation (3.44), and (11) adult and young farmer program (3.05).

There was a tendency for teachers with increasing experience and graduate training to rate the courses correspondingly higher. Teachers preferred more hours in professional education and technical agriculture and fewer hours in general education. Administrators considered that teachers with 7 - 10 years' experience and holding the Master's degree were generally most competent.

371 pages. $4.64. Mic 56-770

EDUCATION, GUIDANCE

AUTHORITARIANISM AND ITS RELATIONSHIP TO GROUP STRUCTURE

(Publication No. 15,758)

Ralf Albert Peckham, Ed.D.
Michigan State University, 1954

The Problem. This was a causal-comparative study of two contrasting experimental samples taken from a given research population. Though presumed to be otherwise homogeneous, these two groups were differentiated according to the presence or absence of a particular personality variable known as "authoritarianism" which primarily characterized each.

The purpose of this study was to investigate this variable of "authoritarianism" in terms of its influence over the types of attitudes that individuals would possess toward different types of group structures. The major hypothesis of the study was that individuals possessing high degrees of authoritarianism would be more prone to have favorable attitudes toward group structures of greater rigidity such as the speaker-dominated, passive-listener type; and that individuals low in authoritarianism would tend to be more favorable in attitude toward the more plastic types of group structures such as the leader-guided, group-centered organization.

Methods, Techniques, and Data. The questionnaire-study was employed as the technique most appropriate for a group approach to the problem. In arraying the research population along a continuum of "authoritarianism", the "F" scale of the Frenkel-Brunswik studies was employed. The top and bottom quarters of the resulting distribution were used as the contrasting experimental samples. In addition to the "F" scale, six other subscales were experimentally devised and included with the study materials. Each of these subscales related to a particular group structure stereotype, each one of which represented a step progression from a group structure of extreme rigidity on down through various modifications ending with a stereotype of rather complete non-rigidity.

Mean responses of each experimental group to each scale item were obtained. The differential performances of the two groups were then contrasted in terms of their level of significance.

Findings and Conclusions. The assumptions upon which this study had been predicated appeared valid. The "authoritarian" group was observed to possess a significantly different pattern of attitudes toward the various kinds of group structures than did the non-authoritarians. These differences were almost invariably in the direction of attitudinal responses indicative of greater preference for rigidity in structure than those possessed by the non-authoritarians. Of the sixty items comprising the several subscales, 52 responses of greater preferential attitude for rigidity were obtained from the authoritarians. Of the remaining eight, five responses were of about equal weight for both groups and three were found to be weighted in the direction of the non-authoritarian sample.

In ascribing a rank order of preference for these six different group structure stereotypes, both groups evidenced a regression toward the mean in selecting the middle group-structure stereotype, expressive of semi-rigidity, as their most popular choice. However, in ranking the extremes, or end-group structures, the authoritarians demonstrated marked preference for the highly rigid structures in comparison with the non-authoritarians, whereas the latter demonstrated marked preference for the highly plastic structures in comparison with the authoritarians.

A major conclusion of the study was that the arbitrary employment of highly democratic processes in group conferencing would not necessarily meet the personality needs of a given group membership any more than would the major employment of the more traditional and rigid types of group structuring procedures. The inference is suggested that a middle ground compromise tends to find more common support from the most numbers although special adaptations might well be made in either direction if knowledge about the "authoritarian" characteristics of the group membership is known.

245 pages. $3.06. Mic 56-771

EDUCATION, HISTORY

ORIGIN AND DEVELOPMENT OF INDUSTRIAL EDUCATION IN NEW MEXICO

(Publication No. 14,947)

Lawrence Mont Frederick, Ed.D.
University of Missouri, 1955

Major Adviser: H. H. London

Purpose of Study: The purpose of this study was to reveal the origin and trace the development of industrial education in New Mexico, indicating the attention given to industrial education in this agrarian state.

Sources of Data: Data for the study were secured from the following sources: reports of New Mexico state education agencies; books and theses compiled on New Mexico history; New Mexico education journals; college and university bulletins; personal interviews; letters from Chambers of Commerce and county and city school superintendents; information forms from individual schools and industrial corporations.

Summary: Industrial education has functioned in New Mexico while the territory was governed by Spain, Mexico, and the United States.

Prior to 1900, all forms of industrial education in New Mexico were vocational in intent.

The first manual training program was established in Santa Fe High School in 1900.

Elementary schools first offered manual training through woodworking instruction in Farmington in 1908.

New Mexico Normal University at Las Vegas, inaugurated the first manual training teacher-preparing curriculum in 1900.

From 1900 to 1917, manual training expanded slowly in New Mexico with most of the development occurring in the elementary schools.

With the acceptance of the provisions of the Smith-Hughes Act by New Mexico in 1917, the entire state became industrial education conscious. Both industrial arts and trade education benefited from this new consciousness.

The Federally-aided program commenced with the formation of an all-day unit trade class in wireless telegraphy at New Mexico A. and M. College. After 1919, the vocational-industrial program developed largely through the part-time trade extension and the all-day general industrial classes.

The different industrial education programs in New Mexico developed in various ways between 1920 and 1940. Organized apprenticeship was dormant until the formation of the New Mexico Apprenticeship Council in 1939. Industrial arts expanded steadily until forty secondary schools were offering such shopwork by 1940. The vocational-industrial program developed sporadically, alternating between high and low periods of enrollment and financial support.

The initial professional course-work available to trade teachers was offered at New Mexico Highlands University in the summer of 1934.

Corporation in-plant training was started in New Mexico in 1929 at the Clovis plant of the Southern Union Gas Company.

Vocational programs in the educational institutions for handicapped persons of New Mexico were expanded. A Federal-state program in vocational rehabilitation was organized in 1923.

Beginning in 1941, emphasis in industrial education in New Mexico was on defense and war production training.

The training that functioned during World War II has influenced industrial education in the state. Since 1946, many public schools have secured shop equipment from war surplus and with this equipment have been able to introduce non-vocational shopwork into their curricular offerings.

Trade instruction which had been slanted toward the mechanical trades during the war tended to remain in the same general pattern. The Servicemen's Readjustment Act provided many New Mexican veterans with the opportunity to study an industrial occupation.

Although two institutions of higher learning in the state had been preparing industrial arts teachers, emphasis was placed upon this industrial teacher-training after World War II.

Conclusions: Apparently, industrial education has had an extensive role in the educational development of New Mexico. However, the quality of the total program probably would have been improved had there existed statewide supervision of both industrial arts and vocational-industrial education.

Financial inadequacy has been a key factor in the development of industrial education in New Mexico.

281 pages. $3.51. Mic 56-772

A HISTORY OF THE PROVISION FOR MENTALLY RETARDED CHILDREN IN THE STATE OF WASHINGTON

(Publication No. 15,708)

James Marshall Laing, Ed.D.
University of Washington, 1955

Supervisor: Alice H. Hayden, Ph.D.

In the Territory of Washington there had prevailed a spirit of understanding of the meaning of public education as an instrument in molding state and national life. There developed a recognition of the need for a territorial school in which handicapped children, the deaf and the dumb, the blind, and the feeble-minded, might be trained to become useful, happy, and self-respecting members of the various communities of the state. To this end, the Washington School for Defective Youth was established in 1886.

Like other schools of its kind, its beginning was humble and its survival precarious. Yet it did survive and it did grow. Indeed it became necessary to divide the School for Defective Youth into two institutions, one for the blind and the deaf, and the other for the feeble-minded. At present a second school for the mentally retarded is operating in the western part of the State. This study deals with the

history of these schools and other provisions for the mentally handicapped youth of the State.

The purpose for this thesis was to collect and record the historical material relating to the provisions for mentally retarded children in the State of Washington. The pressing need for such a history was predicated on the recognition that documentary material and persons with first-hand knowledge of the past are becoming more and more difficult to locate, making it increasingly difficult as time passes to collect accurate historical evidence.

This study has traced the step-by-step development in providing for mentally handicapped children from the earliest legislative enactments pertaining to the education and custodial care in the Territory of Washington, to the present time when the work of educating the mentally defective child has become highly specialized and well established.

Methods and Materials Used

The method of investigation has consisted of a search through records and reports of the various state institutions and organizations having shared through the years in providing for the care, education, and training of the mentally defective youth in the state. Individuals with first-hand knowledge of the organizational phases bearing upon the subject were interviewed or approached by personal letter. Attention was given to current professional journals and the developments in the area of the mentally retarded which were brought about as a result of the experience gained under previous provisions.

As classification played an important role in the provision for mental deficiency in the past, considerable attention was given to classification according to degree and to cause. A general history of the movement from Europe to the United States was reviewed to give a broad picture of what has developed through the years.

The session laws of both the Territorial Period and the Period of Statehood bearing upon the problem of mentally defective children were perused to provide pertinent information regarding legislative provisions.

Historical development of the provisions made by the institutions for mentally retarded children and by the public school systems of the state were studied. The work of the organizations of the parents and friends of mentally handicapped children was also explored. The State of Washington was instrumental in the effective development of strong state and national organizations.

291 pages. $3.46. Mic 56-773

EDUCATION, PHYSICAL

THE INFLUENCE OF PLAY UPON SOCIAL AND EMOTIONAL ADJUSTMENT WITH IMPLICATIONS FOR PHYSICAL EDUCATION

(Publication No. 15,829)

Warren Parker Fraleigh, Ph.D.
The Ohio State University, 1955

The study is concerned with the evidence indicating a relationship between the play experiences of children and youth and their social and emotional adjustment. It entails no new experimentation but seeks to analyze, collate, and synthesize the evidence from other investigations.

A survey of research and the literature of opinion which could be found from the period 1934 to the present was undertaken.

Evidence indicates that a relationship exists between skill and achievement in play activities and social and emotional adjustment among boys and young men from the early grades through the college years. Such a relationship does not seem to exist for girls and young women beyond the early school years.

Participation in play and recreation seems not to be an important causative element in improved social and emotional adjustment. However, skillful participation in the normal pattern of social and competitive play is generally associated with better adjustment, while participation in individualized, less competitive play is associated with poorer adjustment.

Some evidence from play therapy indicates that play experiences have resulted in better social and emotional adjustment for children. There is little valid evidence of a cause and effect relationship between physical education class experiences and better adjustment, although changes have been shown to accompany experiences in physical education. Research here has lacked a design which would allow cause and effect conclusions to be drawn.

The author concludes that skillful participation in the normal pattern of social and competitive play is an important causative element in the levels of social and emotional adjustment which children and youth exhibit. The reasons for this conclusion are: (1) higher levels of skill in play are related to better adjustment, (2) changes in adjustment have accompanied and have been caused by play experiences, (3) physical skill is the most important prestige trait among the child's and the adolescent boy's peer cultures, and (4) play is the most important single area of social experience in the development of children and youth and, consequently, it must have a tremendous influence upon the individual's evaluations of "self," of others, and of desirable ways of relating self to others.

The conclusion is reached that the influence of play upon social and emotional adjustment may be desirable or undesirable. That is, skillful participation in the play activities valued by the peer culture will lead, generally, to better adjustment, while unskilled performance may lead to inferiority feelings and group rejection. Those who are skillful in the valued activities will tend to continue participating, while those who are unskilled will tend to withdraw into more individualized and less competitive play. Such withdrawal leaves the unskilled performer in a handicapped position in terms of the quantity and quality of social experience needed for desirable development and adjustment.

The three factors which seem to condition desirable influences of play on social and emotional adjustment are: success (in terms of skill), opportunities for expression and release of repressed feelings, and the positive emotional tone of the atmosphere in which play takes place. Recommendations, based on these factors, are made for the practice of physical education.

Research is needed to determine the specific and generalized effects of physical education experiences on student adjustment. Recommendations are made for research areas and designs.

The dissertation contains an organized bibliography of nearly 400 titles. 251 pages. $3.14. Mic 56-774

AN INVESTIGATION OF THE EFFECTS OF PHYSICAL TRAINING ON CARDIOVASCULAR COMPONENTS IN THE ADULT MALE

(Publication No. 15,242)

Robert Everett McAdam, Ph.D.
University of Illinois, 1955

Purpose To determine the role of physical training in the important problem of reducing peripheral resistance and hypertension.

Method An experimental, case study approach using six subjects was employed.

Four subjects with varying levels of physical condition were given two batteries of tests, one designed to evaluate general physical condition and the other designed to measure peripheral resistance, before and after adopting a five month training program. Two other subjects were tested with the same test batteries approximately each 2 1/2 months; one subject, starting at a high level of physical condition detrained for the first 2 1/2 months and trained for the last 2 1/2 months. The other subject, beginning at a high level of physical condition, acted as a control by continuing with training.

The formula: $W = \frac{P_m}{Vs \cdot R}$ which has been used by Ralston and others to compute peripheral resistance, was used to determine both quiet and post exercise peripheral resistance in these subjects, P_m being the average of the diastolic and systolic blood pressures, V_s the stroke volume in c.c. and R the heart rate in seconds. The Grollman method with corrections (by Chapman and Keys) for the solubility of acetylene in blood and for the effects of forced rebreathing on the arterio-oxygen difference was used to determine stroke volume. The effect of a systematic error in the cardiac output determinations of some subjects, apparently caused by the forced rebreathing procedure, was minimized by using only the first trials of the subject for each day. A test and retest for first trials on six subjects in the quiet sitting state yielded an r of + 0.83 $\pm$ .184; and a test and retest on five subjects in the post exercise state yielded an r of + 0.80 $\pm$ .187. The statistical significance was then evaluated by the use of Fisher's tables by comparing the change in peripheral resistance with the standard error of measurement of differences between tests and retests.

Results The peripheral resistance was reduced in all subjects who carried out the five month training program (which was not the same for all individuals). The following table summarizes the statistical significance of the changes: (Significance tested at the five percent level of confidence)

Subject	Sign. Ratio $T_1 - T_2$	Sign. Ratio $T_2 - T_3$	Significant
L.T. (Hypertensive)	1.398	--	yes
S. C.	.598	--	no
J. W.	1.025	--	no
R. M.	.568	.582	no, no
B. O. (Detrained)	1.536	1.775	Yes, Yes
E. R. (Control)	.161	.038	no, no

Peripheral resistance reduction resulted primarily from the reduction of mean blood pressure, increase in cardiac output or a combination of these. Mean blood pressure shifts were seen to be functions of either systolic or diastolic shifts, rather than of diastolic shifts alone. The peripheral resistance changes in the subject who detrained resulted almost completely from shifts in the cardiac output. Increased cardiac output during detraining in his case was interpreted as part of a "lag" which Michaels describes in a study on four subjects.

The immediate reduction of peripheral resistance from the quiet sitting to the post exercise state indicated an autonomic response to exercise. The motor performance, physique and neuromuscular test batteries were examined for reflection of autonomic nervous changes which might accompany the peripheral resistance change. It was found that visual reaction time, standing and exercise pulse rates, R wave of the ECG, brachial pulse wave, systolic and diastolic amplitudes and basal metabolic rate shifted almost always in the same way when peripheral resistance was reduced, and these were taken to be indicators of greater sympathetic activity.

Conclusions 1. Peripheral resistance either in the quiet sitting or post exercise states, or both, is reduced during prolonged physical training. This occurred in four out of four subjects who trained for five months, but not in the exercise control subject. It was also reduced in the one subject who detrained for 2 1/2 months.

2. The shift in components of the peripheral resistance formula when reduction occurs has a variable pattern, and may result from a change in one or a combination of the components of mean blood pressure, stroke volume or heart rate.

3. The effect of exercise in reducing peripheral resistance indicates action of the autonomic nervous system which is accepted as the cause of vasodilatation. Over five months of training, the reduction of peripheral resistance probably indicates a persistent shift toward greater sympathetic nervous activity.

135 pages. $1.69. Mic 56-775

EDUCATION, PSYCHOLOGY

TO DETERMINE THE NATURE AND SIGNIFICANCE, IF ANY, OF CERTAIN DIFFERENCES IN THE SOCIAL AND PERSONAL ADJUSTMENT OF FIFTY-ONE SUCCESSFUL AND FIFTY-ONE NON-SUCCESSFUL COLLEGE STUDENTS AT TEXAS SOUTHERN UNIVERSITY

(Publication No. 13,600)

Matthew Nathaniel Cooper, Ph.D.
New York University, 1955

This thesis concerned itself with the determination of the significance of the differences between college students who succeed and those who do not succeed. The search for differences was primarily in the area of social and personal adjustment, and used the Minnesota Multiphasic Personality Inventory; An Inventory of Factors STDCR; The Guilford-Martin Inventory of Factors GAMIN; The Guilford-Martin Personnel Inventory; the Kuder Preference Record Vocational Form G; the Army General Classification Test, First Civilian Edition; the Group Membership Record; The American Council on Education Personality Report; The W-A-Y Technique; and an estimate of the expected terminal grade-point average.

A review of the literature concerning the variables related to academic success revealed that there was general agreement that academic success in college is related to academic success in high school, achievement test scores, and intelligence or aptitude. There is a lack of general agreement in the earlier studies about the relationship between academic success and non-intellective variables. The later studies indicated that there is a relationship between academic success and non-intellectual variables.

Fifty-one students who had grade-point averages of at least one were paired with fifty-one students who had grade-point averages of less than one on the Army General Classification Test.

Using the instruments named above, data on each instrument for each subject were obtained. From this data the significance of the difference in the means or proportions was obtained using either the critical ratio or the t ratio, whichever was appropriate. Significant differences between academically successful students and non-successful students were found for the responses on the MMPI F Scale, the Group Membership Record Social Status responses, the Level of Aspiration measures, the agreement of the Kuder Preference Record results with chosen major subject, and MMPI Items 93, 298 and 472.

The findings of this study indicate that, if recognition is given to results which suggest validity for discrimination between the groups studied as well as the results accepted as indicating true differences, as compared with the successful student:

1. The non-successful student tends to be more careless, less self-critical and tends to have less ability to comprehend the items or material presented to him.
2. The non-successful student is not any more likely to be depressed and have a feeling of uselessness.
3. The non-successful student is more likely to have interests which deviate toward interests of the opposite sex when only the females' responses to the MMPI are considered.
4. The non-successful student tends to be less self-analytic or meditative.
5. The non-successful student more often chooses a major subject that is in keeping with his measured interests on the Kuder Preference Record.
6. The non-successful student tends to impress his teachers as having less emotional balance.
7. The non-successful student is definitely less likely to be chosen by a classmate as a suitable partner for work on school projects.
8. The non-successful student is more likely to identify himself by name.
9. The non-successful student will definitely have a lower grade-point aspiration.

With the exception of the MMPI items and the Kuder Preference Record, the variables showing the significant differences were correlated with the results on Question E of the ACE Personality Report, the Guilford-Martin T Scale, the college grade-point average and the high school average. From the results a multiple prediction formula and multiple correlation coefficient, which increased from 404 to .555, were obtained.

233 pages. $2.91. Mic 56-776

FACTORS INFLUENCING COMMUNICATION IN COUNSELING

(Publication No. 14,945)

Paul Thomas Correll, Ed.D.
University of Missouri, 1955

Major Adviser: Paul C. Polmantier

PURPOSE:

It was the purpose of this study to investigate factors which might operate to influence the quality of communication in counseling. Specifically the purpose was to answer the following questions:

1. Are there clearly definable variables that operate within the initial counseling situation to affect the communication obtaining between a counselor and a client?
2. How may these variables, if present, be best described?
3. In what ways do these variables operate in the interview situation?
4. How are these variables regulated, manipulated or controlled so as best to achieve a more productive communication situation?

METHOD OF RESEARCH:

In order to answer the above questions, fifty-two initial counseling interviews were analyzed. This was accomplished by: (1) sorting them into "good", "fair" and "poor" categories on the basis of a combined criterion which was composed of the global impressions of three judges, together with their responses to a rating scale, and (2) comparing the "good" and "poor" groups thus obtained with regard to several factors which had been suggested by past research as possibly contributing to the success of

the communication process. As an aid to further research, the nature of the criterion was described in detail, and further methods of investigation were proposed and outlined.

SUMMARY:

A summary of the findings follows:

1. Through reading typescripts, the judges were able to rate communication within the interview as "good" or "poor", with somewhat less ability noted in the case of the "fair" category.
2. The rating scale employed proved to be well suited to judging the material at hand.
3. Factors which significantly differentiated between "good" and "poor" interviews were:
   a. The client's expressed satisfaction with the interview.
   b. The overall length of the interview.
4. Factors which failed to differentiate significantly were:
   a. The proportion of client talk.
   b. The experience of the counselor.
   c. The degree of fulfilment of the client's pre-interview expectations.

CONCLUSIONS:

1. The client's expressed satisfaction with the interview experience is a sensitive indicator of the quality of the communication in the interview situation.
2. There is a positive relationship between the length of the initial counseling interview and the quality of the communication in the interview.
3. The proportion of client talk is not significant in differentiating between "good" and "poor" initial counseling interviews.
4. Fulfilment of client expectation is not a significant factor in differentiating between "good" and "poor" communication in the initial counseling interview.
5. Expert judges are able to rate typescripts of initial counseling interviews on the basis of what constitutes "good" and "poor" communication situations.
6. The Interview Rating Scale is a sensitive instrument for determining the quality of the communication within the initial counseling interview.
7. A proposed method for the further analysis of interview typescripts, the Index of Appropriateness of Response, has possible value for use in research into the counseling process.

175 pages. $2.19. Mic 56-777

COUNSELOR PREPARATION IN THE COLLEGES AND UNIVERSITIES ACCREDITED BY THE NORTHWEST ASSOCIATION OF SECONDARY AND HIGHER SCHOOLS

(Publication No. 15,695)

Marguerite Ruth Dressler, Ph.D.
University of Washington, 1955

Supervisor: John E. Corbally, Ph.D.

The purpose for the study, "Counselor Preparation in the Colleges and Universities of the Northwest Association of Secondary and Higher Schools," was (1) to investigate the academic preparation of counselors employed by the four-year colleges and universities of the Northwest Association; (2) to compare the preparation of this group of counselors with standards of preparation recommended by the American College Personnel Association; (3) to examine the curricula of the colleges and universities belonging to the Northwest Association in the areas of study recommended by the American College Personnel Association for the preparation of college counselors.

Data concerning the academic background of counselors were gathered by means of a questionnaire, the items of which were based primarily upon the training recommendations of the American College Personnel Association. The questionnaire was distributed to counselors by an administrator on each campus who was closely connected with counseling, student personnel services, or academic personnel.

Information pertaining to available coursework for the preparation of college counselors was obtained from the catalog of each institution. Upper-division and graduate courses providing training in a common core of six areas of preparation and graduate courses related to three types of special training were analyzed in departments of education, departments of psychology, and departments of sociology. The areas of the common core consisted of personality, social psychology, psychology of learning, mental tests, interviewing, and higher education. Advanced educational and psychological measurement, occupational analysis and information, and psychotherapy constituted the three types of special training.

There appeared to be ample opportunity for training at the level of the Master's degree among institutions belonging to the Northwest Association. Training at the doctoral level was available but much more limited than at the Master's level.

Upper-division students could find many courses which would provide a foundation for graduate work in five of the six areas of the common core. Coursework was not presented at the upper-division level in the area of higher education.

Departments of education offered graduate courses in all areas of the common core; departments of psychology, in five of six areas; departments of sociology, in two of six areas.

The prospective counselor could obtain the most extensive training by taking a major in a combined program of psychology and education, supplemented with work in sociology.

On the basis of replies from sixty-one of the sixty-nine institutions contacted, the majority of the 144 respondents to the questionnaire held either the Master's degree or the

Doctor's degree with majors predominantly in psychology or education. A small group held the Bachelor's degree as the highest degree earned. Both the Bachelor's group and the Master's group were attempting to improve their training for counseling by working on a higher degree than they currently held.

Evidence was found to support the recommendation of the American College Personnel Association that the college counselor should have a degree higher than that of the Bachelor's degree. The group holding the Bachelor's degree as the highest degree earned had had significantly less contact through coursework with the common core of academic preparation and with types of special training than would be expected on the hypothesis that the Bachelor's group, the Master's group, and the Doctor's group were homogeneous with respect to academic preparation.

When consideration was given to the fact that the Bachelor's group was in the main working on a Master's degree, the group of 144 respondents on the whole may be regarded as having met the recommendations of the American College Personnel Association.

192 pages. $2.40. Mic 56-778

REJECTION OF MEASURED VOCATIONAL INTEREST AREAS BY HIGH SCHOOL STUDENTS

(Publication No. 14,953)

Wilfred Lee Shoemaker, Ed.D.
University of Missouri, 1955

Major Adviser: Paul C. Polmantier

PURPOSE:

The purpose of this investigation was to study the extent to which measured vocational interests are rejected by high school students on various grade levels. In order to make a thorough study of rejection the extent to which measured vocational interest areas are accepted was studied also. Specifically the purpose was to answer the following questions:

1. Do areas of rejection and acceptance show similarity throughout high school and to what extent are they characteristic of certain levels of development?
2. Are there definite trends in the measured vocational interests of adolescents throughout the high school period?

METHOD OF RESEARCH:

The Kuder Preference Record (Vocational), Form CM was administered to the white student population of five Missouri high schools. A total of 2,338 students was tested. Throughout the investigation the sexes were handled as separate groups. Tests of significance of differences were made between the observed and expected percentages of scores that fell below the 25th percentile rank in each area, for the total sample and for each grade level. Also tests were made between the observed and expected percentages of scores that fell above the 75th percentile rank in each area, for the total sample and for each grade level.

SUMMARY:

1. Rejection was shown for the Persuasive, Musical, and Social Service areas by the total sample of boys.
2. Rejection was shown for the Outdoor, Mechanical, Scientific, Persuasive, Artistic, and Musical areas by the total sample of girls.
3. There were no areas of acceptance for either boys' or girls' total samples.
4. A breakdown of the total sample of boys into grade levels revealed that rejection was shown for the Persuasive, Musical, Social Service, Outdoor, Scientific, and Artistic interest areas on various grade levels. Only one grade-level acceptance was shown. That acceptance was of the Computational area on grade-level 12.
5. A breakdown of the total sample of girls into grade levels revealed that rejection was shown for the Computational, Persuasive, Mechanical, Scientific, Outdoor, Artistic, Literary, and Musical interest areas. Only one grade-level acceptance was shown. That acceptance was of the Clerical area on grade-level 11.

CONCLUSIONS:

1. High school students of both sexes reject certain identifiable vocational interest areas measured by the Kuder Preference Record (Vocational) on various grade levels.
2. High school students of both sexes accept only a small number of the vocational interest areas measured by the Kuder Preference Record (Vocational) on various grade levels.
3. High school students of both sexes show wide variations of measured vocational interests among grade levels. This suggests that norms should be provided for each high school grade level based upon representative sampling to determine further the feasibility of using present published norms for counseling purposes.
4. Areas of rejection and acceptance do not show similarity throughout the high school period. They are characteristic only of certain grade levels.
5. There are definite trends in the vocational interests of adolescents as measured by the Kuder Preference Record (Vocational) throughout the high school period. Significant is the tendency of boys to reject Persuasive, Musical, Social Service, Outdoor, Scientific, and Artistic interest areas, and of girls to reject Persuasive, Mechanical, Scientific, Outdoor, Artistic, Literary, and Musical interest areas on various grade levels. Few clear-cut trends of accepted interest areas for either sex are discernible.
6. Vocational interests of high school students of both sexes as measured by the Kuder Preference Record (Vocational) are not stable in the time-span studied. Consequently it is unwarranted to use the Kuder for purposes of vocational planning on grade-level nine.

123 pages. $1.54. Mic 56-779

THE EFFECTIVENESS OF COUNSELING PROVIDED UNDER THE VETERANS ADMINISTRATION VOCATIONAL REHABILITATION PROGRAM

(Publication No. 15,683)

Conrad Wesley Snyder, Ed.D.
Temple University, 1955

Problem

The over-all purpose of this study was to determine the efficacy of counseling provided in the Veterans Administration Vocational Rehabilitation Program under Public Law 16, 78th Congress, as amended.

Specifically, this study was concerned primarily with an evaluation of the counseling of two groups of disabled veterans who had trained under the aforementioned law. One group, known as "rehabilitated" cases, had completed their training. The other group, called "discontinued" cases, had terminated their training short of completion.

In order to carry out the investigation, it was deemed necessary to secure and collate collateral data on the two groups with respect to (1) their pre-training and training characteristics; (2) their post-training occupational adjustments; and (3) their reactions to the Vocational Rehabilitation Program and its related services.

Procedure

The sample consisted of 219 disabled veterans, of whom 139 were in a "rehabilitated" status and 80 were in a "discontinued" status. All the veterans were respondents to a questionnaire that was sent to 252 veterans in the Philadelphia area (86.9 per cent response). All the veterans had terminated their training at least two and one-half years before the present study was initiated.

The data were secured from three main sources: (1) Counseling and training records; (2) The responses of the veterans to the questionnaire; and (3) The results of an evaluation of the counseling provided each veteran. The evaluation was made on the basis of counseling records, which were rated "adequate" or "inadequate" on each of 40 a priori criteria.

The chi square technique was employed to test the significance of differences found between the "rehabilitated" and "discontinued" groups, throughout the study.

Conclusions

Only the more important conclusions which emerged from the procedures described above will be mentioned here. They are as follows:

1. The counseling provided veterans in this study was effective to a marked degree and the purpose of Public Law 16, namely, the restoration of employability of disabled veterans, was in the main accomplished.

2. There was conclusive evidence that disabled veterans who completed their training programs benefited correspondingly more and made better vocational adjustments with greater job satisfaction, than did veterans who discontinued their training short of completion.

3. The results of the study indicated a high degree of client satisfaction with the Vocational Rehabilitation Program in general, and the counseling service in particular.

4. The disabled veterans who completed their vocational rehabilitation training manifested a much higher degree of satisfaction with the counseling and other services of the Vocational Rehabilitation Program than did veterans who did not finish their training.

5. On the basis of the criteria used in this study for the evaluation of counseling, it may be concluded that a very adequate and competent job was generally done by the counselors.

6. The employment objectives selected during counseling were nearly always consonant with veterans' individual abilities, aptitudes and interests.

7. The quality of the counseling of the "rehabilitated" cases, when taken as a group, was found to be superior to that of the "discontinued" group.

8. The results of this study strongly suggest that there is some positive relationship between the quality of the counseling and the outcome of the training program.

9. Of the factors evaluated in this investigation, those affecting the adequacy of the counseling process to the greatest degree seemed to be those concerned with psychometrics, cognizance of personal problems of adjustment, level of the employment objective, occupational exploration, and the necessity of synthesizing all the significant data in the case before reaching a conclusion in respect to an employment objective.

163 pages. $2.04. Mic 56-780

EDUCATION, TEACHER TRAINING

A STUDY OF THE VALIDITY OF THE MINNESOTA TEACHER ATTITUDE INVENTORY AS A PREDICTIVE INSTRUMENT IN THE SELECTION OF GOOD TEACHING PROSPECTS FROM AMONG COLLEGE UNDERGRADUATES

(Publication No. 15,689)

Harry Pyott Day, Ed.D.
The Florida State University, 1956

Purpose of the Study

The major aim of the study was a validation of the Minnesota Teacher Attitude Inventory as a predictive instrument useful in the selection of good teaching prospects from among college undergraduates. The type of validation sought was one in which scores obtained by administering the instrument toward the end of a four-year undergraduate program of teacher preparation were correlated with criteria ratings obtained after the test subjects had been graduated and had been employed as teachers for almost a full school year.

A secondary aim was to test the hypothesis that a common developmental pattern of attitudes exists among undergraduates. Thus, in the event that the validity of the MTAI as a predictive instrument should be tenable, evidence would be at hand for indicating the point at which the instrument could be used early in the undergraduate program.

Procedures

The basic design employed a test-retest procedure. The major phase of the study consisted of a follow-up of 196 student teachers. They were first tested on campus as a single group, then retested a year later as teachers and non-teachers. Criterion ratings were secured from principals and instructional supervisors at the time of retesting the teachers. A second phase consisted of testing a group of 154 students both before and after their internship training. A third phase was a single testing of those groups of students taking the first three required courses in the undergraduate professional curricula in the School of Education at Florida State University. The product-moment correlation technique, simple analysis of variance and the "t" test, were used in treating the data.

Conclusions

There was found to be a slight positive correlation between the MTAI test scores and the criteria ratings employed. Utilizing the principals' ratings as a criterion of success there was found to be an eight per cent improvement over chance if the MTAI were used in the selection of good teaching prospects. Utilizing the supervisors' ratings as a criterion of success there was found to be only a three per cent improvement over chance. The findings indicate that the instrument has very little value for predictive purposes.

Judging by the means of all the samples tested, there is a gradual shift in the direction of the more desirable attitudes during that portion of the program of teacher training at Florida State University which precedes internship training.

Since the findings as regards the primary aim of validating the instrument for predictive purposes were negative, it seemed unwise to press the point regarding the usefulness of the instrument for predictive purposes at even earlier stages in the program of undergraduate training.

Other deductions worth noting may be made from the data obtained and used.

There appears to be a decided shift on the part of first-year teachers in the direction of less desirable attitudes toward children and schoolwork.

This same shift in the direction of less desirable attitudes appears to occur when the undergraduates of Florida State University come in contact with a student-teaching situation.

Age seems not to have much bearing on MTAI scores.

Sex and teaching field appear to have a definite relationship. There is a consistent trend for the males to score lower than the females. There is a consistent trend for the elementary groups to score higher than the secondary academic and secondary non-academic groups.

125 pages. $1.56. Mic 56-781

NORMAL SCHOOL EDUCATION IN THE REPUBLIC OF KOREA, 1952-53

(Publication No. 15,541)

Elisabeth H. W. Dietz, Ed.D.
New York University, 1955

Chairman: Alonzo G. Grace

The purpose of this study is to survey the system of normal school education in the Republic of Korea and to make recommendations for its improvement. The investigator believes: 1) that an educated public contributes to the strength of a country, 2) that the importance of elementary school education is paramount in a country where only a small percentage of the population attends secondary school, 3) that effective elementary school education is dependent upon the quality of its teachers, and 4) that therefore, the system of normal school education, which prepares perspective teachers for the elementary school level, is the most important unit in the educational system.

This study is significant because of its relationship to the total world situation: the need to strengthen democracy in Asia, the value of education in orienting cultural patterns toward democracy, and the influence of teacher education in effecting or accelerating such change. And this study has an additional value: being normative-survey research, it records prevailing conditions which provide perspective for future researchers; it is the first detailed study of Korean normal school education and establishes the condition of such education during the early days of this newly-independent Asian country which is facing problems similar to those of other countries recently released from colonial domination. The information so recorded can be used by the Korean government as a basis for the formulation of policies and the development of plans in the immediate future, and as a measuring rod of progress in the years to come.

The investigator traced the historical development of Korean education, describing the effect of Japanese colonial policy on it, and made a nation-wide survey of normal school education utilizing questionnaire inquiries, observation studies, and interview studies to collect the data. The instruments were developed in Korea with the help of Korean educators, and the opinions of Korean educators were recorded to determine their most important educational problems.

Experience in Korea convinced the investigator that Western educational practices cannot be transplanted directly into an Eastern culture. Feeling the need to learn more about Asian teacher education before making recommendations, she visited schools in five additional Asian countries. Practices used in the Community School program of the Philippines, in the Basic Education schools of India, and their systems of teacher education might be adapted for use in Korea. But this must be done by Korean educators. No foreigner should presume to have the insight necessary to create an educational program suitable for use in an alien culture.

Recognizing Korea's financial difficulties, the investigator made recommendations which could be implemented inexpensively:

1. To decentralize and democratize educational administration, through amending the traditional authoritarian practices as upheld by law.

2. To raise the professional level of educators through a leadership program designed to decrease dependence on foreign technical assistance.
3. To revise the curriculum and teaching methods so as to aid in solving some of Korea's national problems, and to develop responsible democratic citizens.
4. To improve the school plant through cooperative community action and the use of indigenous materials.
5. To increase the financial support of education indirectly through encouraging the development of cottage industry handicrafts and improved agricultural practice. 361 pages. $4.51. Mic 56-782

INDUSTRIAL COOPERATIVE VOCATIONAL TEACHER EDUCATION: WITH SPECIAL REFERENCE TO THE PROJECTION OF A PROGRAM IN THE STATE OF ILLINOIS

(Publication No. 15,857)

Donald Gregory Lux, Ph.D.
The Ohio State University, 1955

The dissertation is concerned with preparing an adequate number of competent trade and industrial teachers for the state of Illinois. It seeks to answer the following questions: (1) What are the educational needs of American youth with reference to trade and industrial education? (2) What do these imply? (3) What potentialities does coöperative education possess for overcoming traditional problems? (4) What is the status and scope of coöperative trade and industrial teacher education? (5) What limiting factors qualify the development and operation of such a program? (6) To what degree can these be overcome? (7) What operating principles and procedures have been successful in these programs? (8) What acceptance would coöperatively trained teachers have in the schools and industries of Illinois?

The socio-economic situation and the potentialities of the coöperative plan as a replacement for traditional methods are investigated, and the findings suggest that such a program can overcome many existing problems.

The coöperative plan, employed successfully for fifty years in the closely allied field of engineering education, has been adapted to trade and industrial teacher education in only three programs in the United States, all in a single state. These programs enrolled over seventy-five full-time prospective vocational industrial teachers in 1954-55. The state of Illinois, comparable industrially, had no students in this category. Coöperative programs — recruiting high school graduates and offering them an opportunity to earn part of their college expenses — are able to attract comparatively large numbers of students. Programs attempting to recruit competent and therefore highly paid tradesmen have failed to attract students.

Traditional training methods do not take advantage of the values obtainable from established teacher education programs. A coöperative program, involving the combined efforts of industry — which provides an optimum of skill training — and the university — which provides academic and professional preparation — can be developed within the framework of state and federal requirements and satisfy management and labor policies.

A year's study was devoted to travel and consultation with officials in coöperative programs in five states to ascertain program characteristics and operating principles and procedures that implement the planning and organization of successful programs.

CONCLUSIONS AND PROFESSIONAL RECOMMENDATIONS

The necessity of equalizing educational opportunities for the changing secondary school population, the move toward the comprehensive high school, the dependence of the economy and the nation's security on an adequate supply of skilled manpower, an evolving concept that trade teachers must be teachers as well as tradesmen, the move toward uniform certification requirements, the growing shortage of competent trade and industrial teachers, and the potentialities of coöperative education have stimulated the following recommendations:

1. The University of Illinois, legally designated trade and industrial teacher education agency for the State, should institute the proposed program. The inadequacy of present methods and the urgent need for personnel require that the potentialities of a coöperative program — to provide larger numbers of competent teachers — be acknowledged. The University should also organize a general advisory committee, on the basis of the charter proposed in Chapter V.
2. The secondary schools should provide further preemployment trade and industrial training. Other agencies are not supplying needed skilled manpower, and equality of educational opportunity for American youth dictates a reorientation of the secondary school program.
3. Professional leadership should develop programs which combine the basic elements of a teacher education program: general, professional, and technical. The integration of industrial vocational education with common school offerings requires comparable preparation.
4. State departments of education should reëvaluate their certification requirements for trade and industrial teachers in the light of evolving educational concepts to assure the preparation of well-qualified trade and industrial teachers.
5. A comprehensive evaluation should be made periodically to determine the effectiveness of the coöperative program and to help insure its continual improvement.
6. The coöperative plan should be employed on a national scale when investigations reveal it may solve problems facing other states.
7. Companion studies should be undertaken to discover the implications of the coöperative plan for programs preparing industrial training department personnel.

268 pages. $3.35. Mic 56-783

RESOURCE UNITS IN INDUSTRIAL ARTS TEACHER EDUCATION: WITH SPECIAL REFERENCE TO THE DEVELOPMENT AND USE OF A GRAPHIC ARTS UNIT ON BOOK PUBLISHING FOR JUNIOR HIGH SCHOOLS

(Publication No. 15,871)

Dwight Wilson Nichols, Ph.D.
The Ohio State University, 1955

The dissertation concerns curriculum organization and method in industrial arts education with reference to the preparation of junior high school teachers, and features the development of a resource unit from the graphic arts industry called Books.

Summary. The problem is defined in Chapter I and the hypotheses involved are identified and developed in Chapter II. These are based on the postulates that have been presented by such leaders as Richards, Bonser, Warner and others. They concern the individual, the social order, the economy, and the school – then, especially, the junior high school movement, which is the subject of Chapter III.

Chapter IV examines the American program of industrial arts education, and Chapter V analyzes the problem of curriculum procedures, especially those integrational types which occur in core curriculums, or at least where richly conceived "resource units" are required. The development of one of these on Books is presented in Chapter VI, which is divided into nine sections as follows:

A. Nature
B. Philosophy
C. Purposes
D. Scope
E. Content
F. Activities
G. Evaluation
H. Development
I. Leads

Chapter VI concludes with nine especially valuable Appendices:

1. Technical Bibliography
2. Professional References
3. Periodicals
4. Films
5. Free Materials
6. List of Theses
7. Other Researches
8. Foreign Papers
9. Fortune Magazine

Description of the Unit. Section F of the resource unit on Books includes a total of 33 specific activities under 12 headings, all the way from a variety of manipulative activities to a vocabulary analysis or "spelling bee." It has breadth and penetration, and is especially rich in interest as well as integrational outcomes such as history, language, mathematics, science, and vocational and industrial orientation.

Recommendations. The richness, effectiveness, and integrational possibilities of the unit derived, presented, and evaluated to exemplify curriculum procedures in industrial arts teacher education – in addition to the background materials presented in Chapters II, III, IV, and V – make it possible to reach the following professional recommendations:

1. Viewpoint. The profession obviously needs to raise its sights concerning both subject matter penetration and method, and especially concerning the development and use of resource units.

2. Research. The rapidly evolving technology has progressed far beyond the comprehension and practice of the industrial arts profession, which means that a coördinated program of curriculum research needs to be organized by all leadership agencies: industrial, institutional, governmental, associational, and fraternal.

3. Industrial Participation. The industries themselves need to be stimulated to participate more widely. The examples of John Woodman Higgins (steel), Dard Hunter (paper), and Edward D. Libbey (glass), in behalf of the industrial arts profession are especially suggestive. Millions of dollars are spent regularly by the industries on developmental research, but their relationship to the schools is neglected.

4. Curriculum Development. This, too, must be a continuous process. It requires organization, experimentation, and evaluation like that presented in Chapter VI.

5. Teacher Education. Reference is made here to the reorientation of both technical and professional courses and to in-service as well as refresher courses on both Bachelor's and Master's levels.

6. Administration. Federal, state, county, and municipal school authorities are called upon to foster curriculum development and especially resource units. The responsibility for progress is theirs.

7. The Literature. This is in extremely short supply and needs to be stimulated, provided it is developed on a research basis.

8. Motivation. The professional associations, the honors groups, and salary awards or bonuses should provide the necessary stimulation for expediting these recommendations.

205 pages. $2.56. Mic 56-784

FACTORS RELATING TO THE CHOICE OF INDUSTRIAL EDUCATION TEACHING AS A CAREER AND THE RETENTION OF THESE TEACHERS IN THE PROFESSION

(Publication No. 14,952)

George William Senteney, Ed.D.
University of Missouri, 1955

Major Adviser: H. H. London

Purpose of Study: The purpose of this study was to ascertain the factors influencing men to enter an industrial teacher education program in college, why those so trained either teach or follow other occupations, how the two groups compare as to background, and how they fare in relation to each other.

Method of Research: Data for the study were collected through an information form mailed to men who received their Bachelor's degrees, with majors in industrial education, during the years 1946 through 1950, from 64 teacher education institutions throughout the United States. Usable forms were received from 1356 graduates.

Teaching and non-teaching graduates were compared by using the chi-square test of independence.

Summary: (1) There were significant differences between teaching and non-teaching graduates in respect to size of the community in which they were reared, highest school grade completed by their mothers, chief occupation

of their fathers, whether or not they had teaching experience in military service, type of institution from which they were graduated, year of graduation from college, degree held, gross annual salary, and job adjustment.

(2) The most important reasons given by the graduates for entering an industrial education program in college were "Interest in this type of work," "High school shop experience," and "Work experience."

(3) More important reasons given for entering teaching after graduation were "Because I was trained as a teacher," "Liked shop work," and "Liked to work with young people."

(4) Over one half of those graduates who left teaching or did not enter teaching gave as their chief reason for doing so "Salary in other occupation attracted me."

(5) The median gross annual salary of those graduates teaching industrial education only was $265 higher than the median salary of those teaching industrial education and another subject (combination).

(6) A graduate degree was worth $331 more than a Bachelor's degree on the median annual salary of the graduates.

Conclusions: (1) Those graduates who are reared in smaller communities are more likely to remain in the teaching profession than are those who come from larger cities.

(2) The group of graduates which is most likely to enter and remain in teaching is the one whose fathers are employed in agricultural and kindred occupations.

(3) Satisfactory high school shop experience, work experience, and an interest in the type of work done in industrial education far outweigh other factors influencing students to enter an industrial teacher education program in college.

(4) The fact that he has trained to be a teacher is the most important single reason for a graduate of an industrial teacher education program to enter the teaching profession. The appeal of shop work, working conditions in teaching, and desire to work with young people are also strong influences on the graduate's decision to teach.

(5) The failure of industrial education majors, to enter or to remain in teaching, may be attributed, for the most part, to more attractive salaries in other occupations and increased opportunities for advancement in these other occupations.

(6) When salary is the primary consideration, a person who graduates from an industrial education program would be wise to secure employment, and remain, in an occupation other than teaching.

(7) Industrial education graduates who desire to remain in teaching would do well financially to earn a graduate degree.

(8) Men who have prepared themselves as industrial teachers would be wise to seek a position teaching industrial education only, if they would secure the maximum financial rewards from teaching.

116 pages. $1.45. Mic 56-785

PERSISTENT PROBLEMS OF TEACHERS

(Publication No. 14,588)

Mary Frances Suggs, Ed.D.
Indiana University, 1955

Chairman: Elvin S. Eyster

The Problem

The problem is a study of specified problems of teachers and the practices employed in the prevention, alleviation, or solution of these problems with implications for the training of teachers. Specifically, the study pertains to specified problems of teachers in five major problem areas: professional growth, personal problems, student discipline, service loads, and supervision of extracurricular activities.

Procedure

A preliminary study of literature pertaining to problems of teachers revealed ten major problem areas. Five problem areas were selected for study: professional growth, personal problems, student discipline, service loads, and supervision of extracurricular activities. From the literature in the five problem areas, two types of data were obtained: (1) major problems of teachers and (2) practices employed for the prevention, alleviation, or solution of these problems. The problems studied were of a general nature encountered by teachers regardless of the teachers' experience, subject-matter specialization, or educational level of employment.

Through a bibliographical and summarization process of the literature in the five problem areas, the following data were obtained relative to major problems: historical background, prevalence, causes, and practices employed for prevention, alleviation, or solution. For the most part, the practices described have been used successfully by teachers. In a few instances, however, descriptions are given of recommended practices which have not been used.

Findings

Much of the literature pertaining to problems of teachers was limited in scope. However, the prevention, alleviation, or solution of the problems appears to be dependent upon four major factors: community attitudes and resources, administrative practices and procedures, teacher-training programs, and teacher attitudes.

Community attitudes and resources. The only real solution to problems of teachers appears to be community understanding of and support for school personnel and school programs. Community understanding is especially desirable for effective implementation of extracurricular programs, prevention and control of discipline problems, and acceptance of teachers as normal citizens. Optimum community support would result in the provision of (1) adequate buildings, equipment, and supplies and (2) sufficient numbers of well-trained school personnel to effect school programs.

Administrative practices and procedures. Many of the problems of teachers are of such a nature that unless administrators take the initiative through democratic practices and procedures in administration of school programs and in social and professional affiliation with community personnel, little can be accomplished by teachers. Through

their knowledge of mental hygiene, educational philosophy, and objectives and implementation of school programs on all educational levels, administrators are able to understand problems of teachers and students and to initiate practices which will prevent, alleviate, or solve the problems before they seriously affect the work of teachers.

Teacher-training programs. Many times courses and experiences in teacher-training institutions fail to prepare teachers for effective performance of in-service responsibilities. Probably programs based on in-service experiences of teachers would be more helpful to teachers.

Teacher attitudes. Many of the problems of teachers exist because of teachers' attitudes toward personal and professional growth. Teachers may prevent, alleviate, or solve some of their problems through personal efforts to achieve and maintain optimum mental and physical health and to participate in individual and group activities which promote personal and professional growth.

Implications

Certain major implications for the training of teachers may be drawn from the findings. Teachers may profit from effective professional courses which give, among other things, consideration to guidance and mental hygiene; educational objectives for all academic levels; problems of administrators, teachers, and students; and responsibilities of teachers to administrators, communities, students, and themselves. Helpful, also, may be practical experiences in professional activities and in the application of principles of guidance and mental hygiene. The inclusion of such activities may depend upon closer relationships and co-operation between teacher-training personnel and public school teachers.

433 pages. $5.41. Mic 56-786

EDUCATION, THEORY AND PRACTICE

A STUDY OF COOPERATIVE ACTIVITIES AS COMPARED TO SUPERVISED FARMING PROGRAMS IN MISSOURI DEPARTMENTS OF VOCATIONAL AGRICULTURE

(Publication No. 14,942)

Raymond John Agan, Ed.D.
University of Missouri, 1955

Major Adviser: G. F. Ekstrom

Purpose: To secure data concerning relationships which exist between cooperative activities and supervised farming programs.

Method of Research: Data were obtained (1) from an analysis of certain records submitted by instructors of vocational agriculture to the Missouri Department of Education at Jefferson City; (2) from other records on file in that office; (3) through interviews with certain teachers of the departments included in the study.

Summary:

1. From the 122 departments selected for the study, sixty had conducted two or more cooperative activities continuously during the preceding three years. Sixty-two had not conducted cooperative activities of a continuous nature. These two groups made up the cooperative and non-cooperative groups used in the study.

2. Students enrolled in departments where cooperative activities were conducted earned approximately $380 more from their supervised farming programs during a four-year period than students who were enrolled in departments which did not conduct cooperative activities.

3. In departments where junior organizations and co-operative sales were conducted it was found that there were 15 per cent more supervised farming programs which included continuous enterprises than in the non-cooperative group.

4. Departments in which two or more cooperative activities were conducted averaged 1.61 more animal units in each supervised farming program than the non-cooperative group. Owning animals cooperatively seemed to be the activity most closely associated with larger numbers of animal units in the farming programs of students.

5. In the departments where plots or farms were handled cooperatively the acres of crops in supervised farming were in excess of 25 per cent more than in the non-cooperative departments.

6. The departments in which two or more cooperative activities were conducted averaged 8 per cent more balanced programs in the supervised farming than in the non-cooperative group.

7. As the number of cooperative activities conducted by departments increased, the size and scope of the farming programs increased.

Conclusions:

1. There seems to be little or no relationship between the number of students enrolled in a department and the conducting of a program of cooperative activities.

2. The size of the farms where the students live, within the range of that of normal farming communities, seems to have little effect upon whether cooperative activities are conducted in departments of vocational agriculture.

3. Certain cooperative activities appear to relate to increased income from supervised farming programs of students participating in such activities. It would seem that increased incomes from supervised farming programs are the indirect result of cooperatively working together, and of increased interest and motivation of the students.

4. The following cooperative activities seem to be especially associated with a higher than average percentage of continuation projects in supervised farming programs:

   a. Cooperative junior organizations
   b. Cooperative sales
   c. Cooperative ownership of animals

5. The following cooperative activities seem to be especially associated with a higher than average number of animal units in supervised farming programs:

a. Cooperative ownership of animals

b. Cooperative feeding experiments

6. The following cooperative activities seem to be especially associated with a higher than average number of crop acres grown in supervised farming programs:

a. Cooperative plots or farms

b. Cooperative junior organizations

7. It appears that the interest and motivation resulting from cooperative activities encourage greater individual efforts in conducting supervised farming programs.

117 pages. $1.46. Mic 56-787

VALUING, VALUES, AND THE EDUCATION OF TEACHERS

(Publication No. 15,810)

Sidney Lionel Besvinick, Ph.D.
The Ohio State University, 1955

The study may be divided, for purposes of summary, into three main divisions: (a) the development of a theory of valuing, (b) the collection and examination of values prized by a selected group of teachers, and (c) the implications for the pre-service and in-service education of teachers which may be drawn from the theory and the data.

Valuing has a dual verbal usage, as appraising and as prizing. When used in the former sense, it describes an intellectual process which is incapable of examination except by the person engaged in it. When used as prizing, valuing refers to some goal or objective which is sought and which may be stated.

Since valuing as appraisal is a highly personal matter, introspection on the part of the evaluator is required if he is to improve his ability to make decisions. Whatever decisions he makes are determined by his present perceptions and his past experiences with that which he perceives. Valuing as appraisal, then, may be defined as a process of reflection and integration in which the individual utilizes his perceptions of what exists in a given situation and his prior experiences with the referents in the field to determine that course of action which he believes will yield the greatest self-satisfaction.

Next, the study deals with the responses given by a group of teachers with respect to educational values. Four teachers and the principal in each of eight schools were chosen as the respondents. The schools themselves were selected from a jury listing of those schools in Ohio which were engaged in a serious, planned effort to improve their instructional programs.

Each respondent was interviewed, and his answers to the interview schedule were tape-recorded. The schedule comprised six questions:

1. What have you tried to do this year that you felt was significant? Why was it significant?
2. What does it take to make a good teacher?
3. If a new teacher were coming to teach in this school, would you have any suggestions to offer him?
4. What is the best feature, educationally, of the situation in which you are working?
5. What, in your present situation, most needs improvement?
6. What program and facility changes would you like to see made in the next three to five years?

The responses were analyzed for value statements which were then categorized. It was found that all but three of the 879 value statements could be reliably categorized by the author into five groupings: (a) teacher's self percept, (b) teacher's relations with students, (c) teacher's relations with others, (d) teacher's perception of curricular practices, and (e) teacher's perception of routine school operation.

Last, the following implications for the education of teachers were drawn from the study. The theory suggests:

1. Increased emphasis on developing skill in perception
2. Extension of the variety of experiences in which teachers engage
3. Providing opportunities for creativity and criticism as teachers learn
4. A study by teachers of codes of ethics
5. Conscious, deliberate efforts to develop introspection or inner direction within teachers

The data suggest:

1. That teachers be encouraged to question, experiment, and seek new procedures
2. An emphasis on the acquisition of social skills by teachers
3. Developing an awareness within teachers of the importance of understanding their students
4. Involving teachers in determining policy

The investigation thus provided a listing of those concepts teachers in schools engaged in improving instruction prize and deem important in education. At the same time a procedure was also provided which an individual can use in deciding whether he wishes to accept the values the respondents have mentioned.

230 pages. $2.88. Mic 56-788

INDIRECT PROOF IN COLLEGE MATHEMATICS

(Publication No. 15,835)

Gordon Richard Glabe, Ph.D.
The Ohio State University, 1955

Statement of the Problem

The problem was to formulate a precise definition of indirect proof and to discover a method or methods which would be as applicable to indirect proofs at the elementary levels of mathematics as at the more advanced levels. Moreover, it was desired that the logic for such methods should be relatively simple and easily understood. Any method should further provide for ease of teaching, so that students will understand it clearly and apply it readily and accurately to new situations.

Procedure

Textbooks covering the material of elementary plane geometry and others extending through some of the more

advanced courses of college mathematics were examined for definitions of indirect proof as well as for discussions and explanations of the method. It was also traced through books on methods of teaching, reports of committees, books on logic, and articles in various periodicals.

Conclusions and Recommendations

While indirect proofs permeate all fields of mathematics, almost all textbook discussion and explanation was found in elementary geometry. Such material was lacking in uniformity and contained inaccuracies as well. In courses which normally follow plane geometry in sequence, there is generally the implicit assumption that students have previously mastered the indirect method of proof. However, in view of the analysis made in this study showing lack of uniformity and clarity of the concept and method of indirect proof, such an assumption appears to be unwarranted.

Many writers have expressed dissatisfaction with the indirect method of proof. In elementary geometry, the number of basic proofs using the method has decreased from the relatively high proportion found in Euclid's Elements to the comparatively small number of theorems proved by the indirect method in most geometry textbooks today. On the other hand, the amount of discussion and explanation of the method in such books has greatly increased since 1930.

Books on methods of teaching mathematics and articles dealing with indirect proof are no more in agreement than the textbooks on mathematics. However, more candid expression of unfavorable opinion with regard to indirect proof is likely to be found in this literature than would be found in textbooks.

Most advances in indirect proof have been in the area of the logic underlying the method. Unless the logic is simply and clearly developed, indirect proofs cannot be clearly understood and accepted. In traditional indirect proofs there are almost invariably some vague reasons which are used to justify certain of the steps in the proof.

The following definitions of direct and indirect proofs were proposed.

A Direct Method of Proof is any method in which the conclusion is deduced by reasoning from the hypothesis and axioms, postulates, definitions, and previously proved theorems alone.

An Indirect Method of Proof is any method in which, instead of proceeding as in the direct method of proof, (1) an equivalent proposition is proved, or (2) the contradictory of the given proposition is disproved, or (3) a proposition equivalent to the contradictory of the given proposition is disproved.

All propositions which can be proved by any method can be proved by the method of inconsistency. The method of contraposition can also be used in most cases. Since these two methods are also relatively simple to understand and use, they are recommended for all indirect proofs. The reasoning in the method of contradiction is perhaps too subtle to be generally recommended. In elementary courses of mathematics, it is recommended that "inconsistent set" and "implicative proposition" be used in the "strict" sense, while in advanced courses and at research levels the "loose" sense is recommended.

234 pages. $2.80. Mic 56-789

THE NATURE OF MATHEMATICAL EVIDENCE AND ITS SIGNIFICANCE FOR THE TEACHING OF SECONDARY SCHOOL MATHEMATICS

(Publication No. 15,740)

Elizabeth Beaman Hesch, Ph.D.
Columbia University, 1955

The purpose of this study is to investigate the nature of mathematical evidence as it functions in human affairs and to consider its relationship to secondary school mathematics for the pre-professional student.

The term "evidence" is used to designate any fact, proposition, principle, relationship, or combination of these used as grounds for forming judgments, making decisions, establishing proof, belief, knowledge, law, settling questions, drawing inferences, making predictions, convincing others, acting intelligently, or any system used for the purpose of establishing relationships among these.

To understand the functioning of mathematical evidence it is necessary to consider the nature of evidence in general. Survey of the literature reveals that there are a number of possible classifications of evidence, none of which may be considered unique or exhaustive, that the value of evidential materials rests upon their characteristics—that is, their relevance, reliability, weight, and sufficiency, that evidence functions only with respect to some framework, and that analogy and intuition have limited evidential functions. There is indication that the greatest degree of precision with regard to establishment of rules for evaluating evidence has been attained in law, that scientific research may be considered second in this respect, followed by historical research, and finally by the judgments made by individuals in the course of daily life.

Mathematical evidence occurs in the form of data or in the form of a model. A mathematical datum is a representation of quantity, order, or some other concept of pure mathematics. A mathematical model is a mathematical system or relationship which functions not only as an entity in itself, but also as a segment of some more inclusive system or systems and which serves as a pattern of operation with well-defined structure and function. It is only through their capacity as elements of a system that quantitative data gain evidential value.

Mathematical evidence may be classified dichotomously as descriptive or inferential, rational or statistical, quantitative or topological, direct or indirect, and so forth. For purposes of this study, its most significant characteristics are relevancy, reliability, weight, and sufficiency.

Relevance is attributed to mathematical evidence through definition and assumption. Reliability depends upon assumptions linking the mathematical to the non-mathematical and upon reliability of descriptive premises on which inferences are based. Two aspects of weight must be considered—first, the weight of the evidence indicating that the chosen model is a good fit, and second, the weight of the evidence within the model itself. These are determined by rational processes. Sufficiency is a function of previously determined weight and often rests upon the judgment of the investigator.

Mathematical evidence enters on sub-microscopic, microscopic, macroscopic, and super-macroscopic levels into nearly all human endeavor. Its use involves setting

up an isomorphism between a mathematical model and the non-mathematical. The validity of its use is closely related to its predictive value and to the definitions and assumptions in accord with which the model is chosen. Hence choice of an appropriate model is crucial.

Consideration of mathematical evidence seems to indicate a need for a new approach to the teaching of secondary school mathematics for the pre-professional student—an approach which emphasizes the evidential functions of the subject. Such an approach would require conscious effort to teach for understanding of basic principles and ideas which are at present not emphasized. It would develop in the student an attitude which would cause him to approach problem situations only with respect to the available evidence and in the light of the given framework and to consider each topic in mathematics as a potential model capable of functioning in an evidential capacity in other areas. 185 pages. $2.31. Mic 56-790

ENGINEERING

ENGINEERING, CHEMICAL

A STUDY OF THE EFFECT OF TRENCH CONDITIONS AND ARCH ENCASEMENT ON THE LOAD-BEARING CAPACITY OF VITRIFIED CLAY PIPE

(Publication No. 15,803)

Lonnie Lee Abernethy, Ph.D.
The Ohio State University, 1955

Three-foot lengths of twelve, eighteen, and twenty-four inch clay pipe were broken in laboratory tests which simulated field practice. The pipes were loaded to failure in wooden test boxes under conditions which represented the best and worst methods of pipe-laying. A comparison was made between tests of unencased and concrete-encased pipe with different bedding materials and side restraint. In these tests, an attempt was made to determine the merits of concrete arch encasement as a method for reinforcing vitrified clay pipe in the field and to discover the effect of trench conditions upon the load-bearing capacity. The author concluded that:

(1) Concrete arch encasement is an effective and practical method for reinforcing vitrified clay pipe to insure adequate supporting strength.

(2) For similar conditions of loading, concrete arch encasement will produce the same increase in supporting strength as undercradling. Concrete encasement provides restraint of the horizontal pipe diameter and increased bearing area when placed over or under the pipe.

(3) The supporting strength of a concrete arch-encased pipe is determined primarily by the depth of the composite beam formed by the pipe barrel and the encasement. For properly bedded pipe, the load-bearing capacity varies with the square of the depth of this section.

(4) Increasing the width of arch encasements, with the thickness of concrete over the pipe held constant, will improve the load-bearing capacity of the concrete-pipe structures as a result of increased bearing area.

(5) Steel reinforcing will increase the effectiveness of concrete arch encasement with good bedding, and the improvement is directly proportional to the steel area.

(6) The supporting strength of arch-encased pipe may be increased by using richer concrete or by prolonging the curing time.

(7) Concrete arch encasement is most effective for clay pipe with the lowest modulus of rupture and the highest modulus of elasticity. The presence or absence of a salt glaze does not appreciably affect the results.

(8) Under load, the concrete-pipe structures behave elastically as a unit up to or very near the point of failure.

(9) The supporting strength of an arch-encased pipe is dependent upon the load distribution over the exposed pipe section, and failure of the structure is brought about by "springing" the pipe out of the concrete encasement.

(10) Increasing the depth of arch encasements, with the thickness of concrete over the pipe held constant, will improve the load-bearing capacity as a result of increased bond between the encasement and the pipe and better support under the concrete arch.

(11) One-half of the supporting strength of vitrified clay pipe may be lost as a result of improper bedding.

(12) Contoured soil or crushed stone may be used to provide good bedding for unencased or concrete arch-encased pipe.

(13) The use of narrow trenches, sheeting along the sidewalls, or thorough tamping of the back-fill material will increase the load-bearing capacity of vitrified clay pipe or will partially overcome the effects of poor bedding.

(14) The probable supporting strength of concrete arch-encased pipe may be predicted from laboratory tests. 197 pages. $2.46. Mic 56-791

THE ELECTRODEPOSITION OF ALUMINUM FROM ALUMINUM CHLORIDE-AMINE-ETHER SYSTEMS

(Publication No. 15,617)

Arthur Constantinos Doumas, Ph.D.
Virginia Polytechnic Institute, 1955

This investigation was an exploration of the feasibility of furnishing aluminum ions for electrodeposition from systems containing aluminum chloride, organic amines, and aliphatic ethers.

A study was made of the binary aluminum chloride-amine systems containing monomethyl amine, trimethyl

amine, monoethyl amine, diethyl amine, n-butyl amine, di-n-butyl amine, tri-n-butyl amine, 2-ethylhexyl amine, di-2-ethylhexyl amine, ethylene diamine, pyrrole, aniline, pyridine, pyrrolidine, diethylene triamine, and quinoline. This study covered the composition, melting point, and stability of aluminum chloride-amine complexes and measurements of decomposition potentials and specific conductance. Exploratory electrolyses performed showed that aluminum was not electrodeposited on a copper, platinum, or steel cathode from electrolytes consisting of aluminum chloride in the range of 0.24 to 13.8 mol per cent and n-amyl amine, n-butyl amine, quinoline, ethylene diamine, diethylene triamine, pyrrolidine, pyridine, and aniline concentrations of 99.76 to 86.2 per cent, employing aluminum and platinum anodes in the temperature range of 26 to 294°C and a cathode density range of 0.08 to 22.87 amperes per square decimeter. Apparently an organo-aluminum precipitate was always produced at the aluminum anode.

Further decomposition potential and conductance measurements were made on three-component systems containing aluminum chloride, organic amines, and ethers. The systems investigated were: aluminum chloride-n-butyl amine-diethyl ether, aluminum chloride-2-ethylhexyl amine-diethyl ether, aluminum chloride-n-butyl amine-tetrahydrofuran, aluminum chloride-2-ethylhexyl amine-tetrahydrofuran, aluminum chloride-n-butyl amine-n-propyl ether, aluminum chloride-2-ethylhexyl amine-n-propyl ether, aluminum chloride-n-butyl amine-n-butyl-ethyl ether, aluminum chloride-2-ethylhexyl amine-n-butyl-ethyl ether, and aluminum chloride-n-butyl amine-n-butyl ether. With the exception of the aluminum chloride-n-butyl amine-n-butyl ether system, exploratory electrolyses of these systems showed that aluminum was electrodeposited on steel and copper cathodes, employing an aluminum anode and cathode current densities from 0.05 to 8.18 amperes per square decimeter. Apparently, ethers with less than eight carbon atoms may be used for successful deposition.

The mutual solubility areas, at a temperature of 25.0°C, were determined for the three systems aluminum chloride-n-butyl amine-diethyl ether, aluminum chloride-tri-n-butyl amine-diethyl ether, and aluminum chloride-2-ethylhexyl amine-diethyl ether. This was done in order to predict the compositions that would be a single-phase solution for electrodeposition experiments.

For the particular system containing 25.6 mol per cent aluminum chloride, 15.2 mol per cent 2-ethylhexyl amine, and 59.2 mol per cent diethyl ether, aluminum was electrodeposited on a copper and steel cathode but the cathode current efficiencies varied from 7.5 to 91.0 per cent. The anode current efficiencies were usually in excess of 100 per cent. Smooth deposits of aluminum were obtained at current densities in the range from 0.43 to 12.56 amperes per square decimeter. This range was determined by constant-current density tests as well as by a plating range technique based on the Hull cell. The conductivity of the bath gradually decreased with quantity of electrolysis, but did not seem to materially affect the ability of the bath to deposit aluminum.

Qualitative observations indicated that more adherent aluminum deposits could be obtained if the base metal employed was first coated with a flash of zinc. Using this preliminary treatment, exploratory electrolyses with the system containing 25.6 mol per cent aluminum chloride, 15.2 mol per cent 2-ethylhexyl amine, and 59.2 mol per cent diethyl ether, in the range of current densities from 1.28 to 2.74 amperes per square decimeter, yielded bright, strongly adherent deposits. 455 pages. $5.69. Mic 56-792

AIR STERILIZATION BY FIBROUS MEDIA

(Publication No. 15,632)

Arthur Earl Humphrey, Ph.D.
Columbia University, 1953

Air sterilization may be accomplished by filtration through fibrous media, with removal of organisms being due to a sieving action or to an irreversible impaction and adsorption of the microorganisms on the fiber surfaces. Although the sieving action assures complete removal of organisms, it is not particularly desirable because the filter life is usually short, being expended as the filter intersticies become plugged.

The design of a filter utilizing the more desirable impaction effect to remove contaminants from air streams is rather complex since the action may result from a combination of interception, diffusional, settling, inertial, and electrostatic mechanisms. To exaggerate the relative effects of these forces, very thin fibrous glass filters (0.12 inches thick) were tested and their efficiencies in removing B. subtilis spores from air streams were compared at various air velocities. Experimental results supported earlier theoretical considerations which indicated that air velocity would determine the effect of the various mechanisms. Electrostatic action in the filters was observed by electroscope measurements on the filter during its operation and a Millikan Chamber was used to measure the electrical properties of the aerosol.

Tests with the glass filters have shown that two opposing velocity effects operate separately within them. At high velocities the inertial mechanism, which is directly proportional to velocity, predominates; at low velocities diffusional and/or interception, which are inversely affected by velocity, are operating. Electrostatic forces can be important at low velocities but their magnitude depends upon the effective charge maintained on the fiber surface and the nature of the aerosol.

At the point where inertial effects disappear there exists a velocity which gives rise to a minimum filtration efficiency. Recognition of the existence of this minimum efficiency at an intermediate velocity is important in sound filter design.

Interception effects, those due to the finite size of the aerosol particle and the flow field pattern, are much smaller than predicted from theoretical calculations with an assumed potential flow field. The results have shown that the Ranz parameters do correctly characterize the inertial electrostatic, and probably the settling mechanism. The interception mechanism, however, does not act as the Ranz parameter indicates it should.

Economic consideration of filter operation in removing a desired percentage of B. subtilis spores indicates that low velocity filtrations are most desirable from the standpoint of filter life and pumping costs. Only in conditions where the filter size is limited or the initial equipment cost are appreciable is high velocity filtration recommended.

126 pages. $1.58. Mic 56-793

ADSORPTION OF BINARY GAS MIXTURES OF CARBON DIOXIDE AND HYDROCARBONS

(Publication No. 15,741)

Robert Vincent Jelinek, Ph.D.
Columbia University, 1953

Although adsorption of individual gases on various porous solids has been studied widely, the development of gas separation processes based on adsorption is retarded by inadequate data on the behavior of multi-component systems.

This dissertation presents the results of a systematic study of the adsorption of binary mixtures of carbon dioxide with ethylene, ethane, propylene and propane on two adsorbents, activated charcoal and silica gel, at 0° and 30°C. Mixtures of hydrogen and carbon dioxide were also studied at 0°C on activated charcoal. In each case, compositions were varied over the entire range 0 to 100% carbon dioxide, and total pressure was kept at substantially one atmosphere. Adsorption of the individual gases was also investigated, and individual isotherm data are presented at 0° and 30°C. A volumetric apparatus of relatively standard design was used, modified to permit circulation of gases through the adsorbent sample.

The individual gas adsorption results are in excellent agreement with comparable data reported in the literature. A graphical method of correlating adsorption data, based on a recent modification of the Polanyi potential theory, was found very satisfactory for expressing the temperature dependence of individual gas isotherms. The factors affecting order of adsorbability on each of the adsorbents are discussed, and close correspondence between heats of adsorption of the several gases and their order of adsorbability is shown by the data.

The results of the mixture studies are presented in the form of tables and diagrams showing corresponding compositions of the gas and adsorbed phases at equilibrium, under conditions of constant temperature and at a total pressure of one atmosphere. The concept of relative volatility, analogous to that employed with vapor-liquid equilibria, is used in analyzing the data.

It was found that activated carbon preferentially adsorbs hydrocarbons from their binary mixtures with carbon dioxide, and that volatility difference increases with increase in hydrocarbon molecular weight. However, volatility reversals are evident at low hydrocarbon concentrations in the CO_2-ethylene and CO_2-ethane systems. (At points of volatility reversal, the gas and adsorbed phases have the same composition.) In mixtures with hydrogen, carbon dioxide is markedly the more volatile component at all concentrations.

On silica gel, ethane and ethylene are more volatile than carbon dioxide in binary mixtures, while propane and propylene are generally less volatile. Volatility reversals were found near both extremes of the composition range in the CO_2-propylene and CO_2-propane systems.

Increase in temperature was found to enhance volatility differences on both adsorbents, and to broaden the range over which no volatility reversals occur. Differences in volatility between carbon dioxide and hydrocarbons were generally greater on carbon than on silica gel.

It was observed that the total quantity of gas mixture adsorbed at one atmosphere lies between the two pure-gas quantities at that pressure, and that the adsorbed phase composition may be expressed by means of a simple equation of proportional displacement. This is in accord with studies of binary hydrocarbon mixtures in the literature. Preferential adsorption from the gas mixtures studied here can be predicted only qualitatively from the individual gas adsorption characteristics, since interactions between the components of the adsorbate result in volatility reversals.

A new approach to the calculation of consistent activity coefficients in the adsorbed phase is suggested, analogous to that used in the field of ion-exchange. This method is applied successfully to the system ethylene-CO_2 on activated carbon. It is not offered as a means of predicting activity coefficients or relative volatilities, but rather as a procedure for analyzing and comparing equilibrium data on various mixtures.

It is recommended that future equilibrium investigations on gas mixtures include study of the effect of pressure as well as temperature, and that they be coordinated with parallel calorimetric experiments as well as vapor-liquid equilibrium studies. 252 pages. $3.15. Mic 56-794

SOME PHYSICAL PROPERTIES OF CERAMIC BODIES AND THEIR RELATIONSHIP TO THERMAL STRESSES IN THE DEVELOPMENT OF COOLING SCHEDULES

(Publication No. 15,852)

Irwin Morris Lachman, Ph.D.
The Ohio State University, 1955

Clay products in commercial kilns are often cooled so rapidly that thermal failure occurs. A method is described whereby safe cooling schedules may be obtained, thus averting failure. The method involves the experimental measurement of four physical properties of a body in the range between room temperature and 1600°F. The properties are: modulus of rupture, modulus of elasticity, thermal expansion, and thermal diffusivity. Experimental values are then combined into the factor $\frac{E\ \alpha}{MR\ a}$ and plotted against temperature. Cooling curves are obtained by graphical integration of this function since the time for cooling from one temperature to another is proportional to the area under this curve. Data for seven firings of three commercial bodies are presented with the calculated cooling schedules. The cooling schedules calculated are relative cooling schedules since factors of size and shape are not evaluated. To ascertain whether any correlation could be made between the seven cooling schedules, quantitative analysis of quartz in the fired bodies was made by an x-ray diffraction method. A correlation between the shapes of the cooling schedules and weight per cent quartz became evident when the curves were reduced to the same total time for cooling.

A hysteresis in the modulus of elasticity and thermal expansion of the specimens was observed during cyclic heating and cooling. Thus all measurements used for calculating the cooling schedules were made during cooling. Separation of quartz from the other phases present during cooling from the quartz inversion (1063°F) to room temperature is offered as the basis for explaining the cyclic variation in the modulus of elasticity and the thermal expansion. Quartz separation is due to the large differential contraction between the quartz crystals and the other phases in the body. The literature is quoted throughout to support the idea of quartz separation. Further tests were made to show that

rebonding between the quartz and matrix will occur upon reheating. 117 pages. $1.46. Mic 56-795

A STUDY OF RATE FACTORS FOR MECHANICALLY AGITATED GAS-LIQUID CONTACTORS

(Publication No. 15,874)

William Oliver Overton, Ph.D.
The Ohio State University, 1955

The performance of a laboratory scale, stirred gas-liquid contactor, referred to as a "pump-mix," was studied by measuring mass transfer rates for the oxidation of aqueous sodium sulfite with air, a 50 per cent oxygen—50 per cent nitrogen mixture and pure oxygen. The reactor studied had a volume of 110 $cm.^3$ Liquid feed rates from 100 to 660 $cm.^3$ solution per minute were studied. The reactor was assumed to operate adiabatically and at complete mixing conditions. Impeller speeds of 1050, 1720, and 2700 were investigated.

The pump-mix had the shape of a short cylinder with a diameter of 4.00 inches and a height of 0.562 inches. A flat, four-blade, cross-shaped impeller was used. Radially mounted baffles and the product outlet were positioned on one wall while the feed inlets and shaft opening were located on the opposite wall.

Results expressed as over-all liquid mass transfer coefficients for runs with adiabatic operation, pure oxygen feed, and a liquid feed rate of 660 $cm.^3$/ minute ranged from a maximum of 1100 at 1050 r.p.m. to another maximum of 7100 lb. mole oxygen/ (min.-$ft.^3$ - mole fraction oxygen) at 2700 r.p.m. The maximum over-all gas mass transfer coefficients for runs with air feed, liquid rates of 400 $cm.^3$/ minute at 2700 r.p.m. amounted to 0.018 lb. mole oxygen/ (minute-$ft.^3$ - mole fraction oxygen). Individual film coefficients estimated from the results at 2700 r.p.m. were as follows: for the gas film $k_G a = 1.75$ lb. mole oxygen/(hr.-$ft.^3$-atm.), and for the liquid film, $k_L a = 2.97$ lb. mole oxygen/(hr.-$ft.^3$ -atm.). The effect of temperature on the over-all liquid mass transfer coefficient was correlated by

$$K_L a = K^* e^{\frac{-3100 \text{ cal./gm.mole}}{RT}}$$

where the 3100 cal./gm.mole is the apparent activation energy of the process. Estimated power inputs were correlated by the equation

$$Hp = (9.31 \times 10^{-11})(\text{per cent L}/100)(\text{r.p.m.})^{2.37}$$

where (per cent L/100) is the fraction of the reactor filled with liquid at steady state operation.

The over-all liquid mass transfer coefficients referred to 125°F., $K_L a_{(125^0)}$, were linear functions of the gas feed rate up to a gas-loading point that was characteristic for each set of r.p.m. and liquid feed conditions. The effects of liquid rate and r.p.m. on $K_L a_{(125^0)}$ were minor when compared with the effect of gas rate. The maximum over-all liquid mass transfer coefficients referred to 125°F., $K_L a$, $max._{(125^0F.)}$ were functions of both liquid feed rate and impeller speed. The observed detrimental effect of inert gas on the reactor performance was greater than could be assigned to the resistance of a gas film. This extra effect is attributed to the effect of the volume of inerts on the displacement characteristics of the reactor.

A comparison of the performance of this pump-mix with the performance reported in the literature for stirred tanks with air feeds showed that the work per unit of reaction required by the pump-mix was higher than required by the stirred tanks. However, mass transfer rates were obtained in the pump-mix which could result in other operational economic advantages that overshadow the higher power cost. 189 pages. $2.36. Mic 56-796

THE PHASE BEHAVIOR AND SOLUBILITY RELATIONS OF THE BENZENE-WATER SYSTEM

(Publication No. 15,882)

Charles J. Rebert, Ph.D.
The Ohio State University, 1955

The study of the phase behavior of the benzene-water system is a continuation of the broad studies and generalizations of partially miscible liquid systems made at the beginning of this century. Within the scope of this investigation are illustrated the continuity of the phase boundaries usually termed liquid-liquid miscibility, gas-liquid solubility, and vapor-liquid equilibrium.

The experimental method used was that developed by Kay (W. B., IEC., 30, 459, [1938]). A mixture of benzene and water of known composition was confined over mercury in a fused silica capillary tube. With the tube, thermostated pressure was applied to the mixture hydraulically through the mercury. Phase changes within the mixture were observed visually.

The pressure at the liquid and vapor phase boundaries of fifteen mixtures of benzene and water were determined within the temperature range from 200°C. to 357°C. Along with a complete numerical tabulation, these data are presented graphically as pressure-temperature, pressure-composition, and temperature-composition phase diagrams to show the nature of the boundaries.

Up to the three-phase critical end point, the benzene-water system develops in a manner usually ascribed to a partially miscible system in which the vapor composition at a point of univariance lies intermediate to the two liquid compositions. The three-phase critical end point occurs at 1364 psia and 268.3°C., and the composition of the critical phase is 25.8 wt. per cent water while the remaining liquid phase is 82.8 wt. per cent water.

The pressure, temperature, and composition of the critical solution end point are deduced as 2300 psia, 306.4°C., and 50 wt. per cent water respectively. At temperatures between these two critical points the phase behavior is likened to that of the solubility of a dense gas or fluid in a liquid. Definite limiting values of temperature and pressure are assignable to this behavior by extending the three-phase curve up to the critical solution end point. This extended curve is not a phase boundary, but the temperature and pressure at a given point represent in a mixture of fixed composition the limit of mutual solubility of the benzene-rich fluid phase and the water-rich liquid phase. At a temperature above or a pressure below the given point, the liquid phase begins to vaporize.

Above the critical solution end point, the vapor-liquid phase boundaries are like those of a normal binary mixture. 94 pages. $1.18. Mic 56-797

ENGINEERING, CIVIL

TRANSVERSE CRACKS IN CONCRETE PAVEMENTS

(Publication No. 14,767)

Henry Alvin Kallsen, Ph.D.
The University of Wisconsin, 1955

Major Professor: Eldon C. Wagner

The object of this thesis is to collect, evaluate, summarize, and analyze data pertaining to the occurrence of transverse cracks in non-reinforced Portland Cement Concrete pavements built in Wisconsin from 1949 through 1954 for the purpose of determining optimum contraction joint spacing.

In 1949 and 1951, sixty-two miles of experimental pavement was constructed on an adequate base with and without contraction joints to observe the development of transverse cracking, stability, and riding qualities. The crack patterns developed on this pavement and on 2.8 miles of dual roadway built in 1952 without contraction joints are analyzed through crack surveys, statistical compilations, and field examinations. The correlation of crack experience with structure, foundation, climate, load, and time is shown graphically.

From 1952 through 1955 contraction joints were sawed at various intervals on various projects. The crack experience on 268 miles of these projects is reviewed.

For eight- or nine-inch, non-reinforced, concrete pavements placed on an adequate foundation according to Wisconsin Highway Commission design and construction procedure, the conclusions are: (1) there is little reason, other than aesthetic, for including filler strip, cleft, or poured contraction joints in the design, (2) if contraction joints are used in an attempt to control random cracking, for aesthetic reasons or public relations purposes, temperature and subgrade friction should receive the least consideration in determining optimum joint spacing, (3) sawed contraction joints are preferable to random cracks, (4) neither 40-foot nor 80-foot spacing of sawed joints is 100% effective in controlling shrinkage cracks, (5) an 80-foot spacing, with provision for early sawing, will adequately control shrinkage cracking since some cracking is tolerable, (6) sawing joints at pavement fixtures and culverts prevents random cracking at these locations, (7) one-inch sawed joints are as effective as two-inch sawed joints at a 20-foot spacing, and (8) aggregate interlock is apparently not imperative on the basis of Wisconsin experience.

399 pages. $4.99. Mic 56-798

TRAFFIC PATTERN ANALYSIS OF THIRTY CITIES IN THE STATE OF NEW YORK

(Publication No. 15,433)

Mohamed Taheri, Ph.D.
Cornell University, 1955

Advisers: Professors T. D. Lewis and J. W. Reps

This investigation was carried out in an attempt to find the possibility of establishing an approximate and quick method of estimating the traffic pattern of any city for which no detailed traffic data are available. The traffic pattern is assumed to be a composite of:

1. the through traffic,
2. the traffic having either origins or destinations in sections of the city other than the central business district,
3. the traffic having origins outside the city limits and destinations in the central business districts, and
4. the traffic having origins within the city limits and destinations in the central business district.

The traffic volumes contained in the origin and destination tables of thirty Urban Area Reports, prepared by the New York State Department of Public Works, are the main source of the data used in this study. From these reports, the four types of traffic volumes are computed for each city and are expressed as percentages of the total volume of the four.

For each city, ten characteristic factors considered to have the most influence in the development of traffic patterns are computed. These are:

X_1. population,
X_2. average population density/sq. mi. of developed area,
X_3. employment-resident ratio,
X_4. manufacturing ratio,
X_5. population to inbound traffic ratio,
X_6. percent employed in retail trade,
X_7. percent employed in manufacturing,
X_8. average traffic on any highway leading into the city,
X_9. population to 12-hour traffic ratio, and
X_{10}. interaction coefficient between cities.

Two methods of approach are used in this study:

1. the establishment of cities having similar traffic patterns and determination of their common characteristic factors (subjective analysis); and
2. the statistical analysis of the data to arrive at four empirical equations (objective analysis).

In the first method, the cities having similar traffic patterns are grouped together by the use of:

1. the tetragon graphs,
2. the median method, and
3. the mean method.

Then the quantitative characteristic factors of the cities in each group are checked for signs of similarities and pattern formations.

From the evidence at hand, it is concluded that the cities having similar traffic patterns do not necessarily

have similar characteristic factors (with the exception of satellite cities). Consequently, this method can not be employed to estimate traffic patterns and thereby traffic volumes.

In the second method, various statistical procedures are used. A linear relationship between each of the four types of traffic and each of the ten factors is assumed to exist. Simple correlation coefficients are computed to measure the relative importance of the ten factors. By using the results of the simple correlation analysis as a guide, the joint effect of the various factors upon each of the four types of traffic are measured by the use of multiple correlation coefficients. The most significant combination of factors are established by means of testing "null hypotheses" and making "F tests." Four predicting equations based on these factors are formulated and the prediction intervals, at the 95% significance level, are established.

From the evidence at hand, it is concluded that some correlations do exist between traffic volumes and some characteristic factors of the city; and it is possible to set up formulas to estimate various types of traffic. However, since the prediction intervals ($\pm$11.7%,$\pm$17.4%,$\pm$7.6%, &$\pm$9.0%, respectively) are rather large, the predicted volume percentages may be used in situations where only a rough estimate of the traffic pattern will suffice.

175 pages. $2.19. Mic 56-799

ENGINEERING, ELECTRICAL

AN INVESTIGATION AND ANALYSIS OF RADIO WAVES OF EXTRATERRESTRIAL ORIGIN

(Publication No. 15,850)

Hsien-Ching Ko, Ph.D.
The Ohio State University, 1955

An investigation of the cosmic radio radiation at 250 Mc./sec. and 242 Mc./sec. made with the Ohio State University radio telescope is described.

A radio map of the sky is prepared, showing the distribution of cosmic radio radiation. The high resolving power of the Ohio State University radio telescope reveals much detailed structure of the background radiation. The distribution of the radio brightness shows a high concentration in the galactic plane and toward the galactic center. The distribution also shows a significant bias to the south of the galactic plane, both in the regions of the galactic center and anti-center. The radio map covers most of the sky observable from latitude north 40^0 and is the most complete map that is presently available.

On the basis of the results of the radio surveys of the sky, a radio model of the galaxy is constructed. The model consists of three components: a disk of ionized gas clouds, an axially symmetric distribution of localized radio sources which are highly concentrated in the galactic nucleus, and an isotropic component whose origin may be extragalactic. There are, in addition, some irregular excesses in the distribution of the radio brightness which may be associated with the spiral structure of the galaxy. The total radiation from the galaxy is approximately 1.7×10^{21} w./cps, and the power emitted by the sources in a cubic parsec near the sun is found to be about 8×10^{8} w./cps/psc^3 at 250 Mc./sec.

The spacial distribution of the radio sources in the model differs significantly from those previously obtained by others. Our model shows a considerably greater concentration of radio sources in the galactic nucleus. Furthermore, our model indicates that the radio sources do not have the same distribution and space density as common stars.

A number of radio sources have also been detected during our radio survey of the sky. Their distribution, spectra, and identification with visual objects are discussed. A striking feature is the large number of extended sources lying near the galactic plane and presumably associated with our galaxy. It is suggested that the radio sources in the model correspond to those which have actually been detected by our radio telescope.

The radio emission from individual ionized hydrogen nebulae, such as the Rosette nebula, North American nebula, and Orion nebula, is for the first time detected at the meter wave lengths. The result of the analysis for the Rosette nebula is consistent with the hypothesis of thermal emission by free-free transitions from the nebula.

126 pages. $1.58. Mic 56-800

A STUDY OF DIRECT-COUPLED AMPLIFIERS FOR LOW-LEVEL SIGNALS AND A METHOD OF LOWERING THE PRESENT LIMIT

(Publication No. 15,404)

Charles Ellsworth Miller, Ph.D.
Purdue University, 1950

Major Professor: Dr. G. E. Happell

The designing of direct-coupled amplifiers to handle slowly varying d-c signals involves considerable difficulty. The output voltage of a conventional direct-coupled amplifier varies in a random manner even though the applied signal is constant. Variations in tube operating voltages, room temperature, or cathode emission produce changes in the output which are called drift. The most serious drift occurs in the first tube. The use of negative feedback reduces the output due to drift and the output due to the applied signal by the same percentage.

This thesis presents the design of a balanced amplifier circuit which uses negative feedback to reduce the effect of drift but avoids negative feedback while amplifying the signal. Hence the signal-to-drift ratio is improved.

The operation of the amplifier follows a cycle. During the first part of the cycle one mercury switch removes the signal while another mercury switch synchronized with the first returns the output voltage to the amplifier input. The resulting negative feedback reduces the effect of drift to a small value. This condition of reduced drift is retained for the other part of the cycle by means of a charged capacitor. During the remaining part of the cycle, the second relay disconnects the output from the input while the first relay reconnects the signal. The signal is amplified

in the usual manner without loss of gain due to feedback. Thus the cycle is completed.

If K is the gain of the amplifier without feedback, the signal-to-drift ratio in the output is improved K times by this method. The circuit corrects for any of the troublesome variations listed above but not for severe line surges. These produce a momentary effect, but the output returns within a few seconds to the correct value.

This circuit can be used with a voltage source of any impedance as long as its value can be determined.

74 pages. $1.00. Mic 56-801

ELECTROMAGNETIC TRANSMISSION THROUGH DIELECTRIC SHEETS

(Publication No. 15,883)

Jack Hubert Richmond, Ph.D.
The Ohio State University, 1955

Radar antennas on aircraft and missiles must be covered with dielectric shells or radomes for streamlining. The radome introduces errors in the indicated target position, and must be designed to minimize such errors. While the optical approximations generally employed in radome design may be satisfactory for large, well-rounded radomes, they are often inadequate for small, highly streamlined shapes. Improved approximate methods of analysis are needed to replace the slow, costly, cut-and-try methods now in use for such radomes.

In seeking an improved design procedure, maximum use should be made of any available experimental measurements. Although the radome is assumed to be in the design stage and not yet constructed, the radar antenna to be used is often available. In this study various techniques were investigated for use in the accurate measurement of the electromagnetic fields near an antenna. The properties of a coherent detector were found to be particularly useful. A sensitivity of -125 dbw was measured with a balanced coherent detector at 9400 mc. This detector permits measurement of time-quadrature components as well as automatic phase measurements.

The scattering method of measuring electric field distributions is capable of unusually high accuracy. To simplify the scattering measurements and at the same time increase the sensitivity and accuracy, a new technique was developed in which a modulated scatterer was employed. A comparison of various probes led to the development of an open-ended wave-guide probe which is of simple construction, has an aperture small enough to measure complicated field distributions, and has proved sufficiently accurate for many measurements.

In radome design it is frequently necessary to calculate the radiation pattern of an antenna covered with a radome. The surface integrations usually involved are simplified if a plane reference surface is chosen. The surface integration may be further simplified to a line integration if the electric fields are separable. The numerical work may be reduced with little loss in accuracy by replacing the continuous field distribution near the antenna with an array of point sources spaced nearly one-half wave length apart. These simplifications greatly reduce the time and effort required to compute radiation patterns.

Conventional radome analysis methods require a mathematical description of transmission through a radome located in the Fresnel zone of an antenna. By an application of the reciprocity theorem, this problem may be replaced by the simpler problem of transmission of a plane wave through the radome from a distant source. A particularly simple result is obtained by this approach for transmission through an infinite plane dielectric sheet inclined at some angle from the antenna aperture. If interaction between the antenna and the sheet is negligible, the radiation pattern with the sheet is merely the unperturbed pattern multiplied by the plane-wave plane-sheet transmission coefficient. This has been verified experimentally.

The theory has also been applied to transmission through finite plane sheets. Simplified approximate calculations have been carried out and yielded satisfactory agreement with measured data. It is believed that these results justify future attempts to apply the theory and techniques to the problems of transmission through curved dielectric sheets and radomes. 76 pages. $1.00. Mic 56-802

ENGINEERING, INDUSTRIAL

THE DEVELOPMENT OF A MODEL TO STUDY THE PLASTIC DEFORMATION OF CRYSTALLINE MATERIALS

(Publication No. 15,827)

David Clifton Ekey, Ph.D.
The Ohio State University, 1955

The purpose of the investigation was to develop a practical model for studying the behavior of crystalline materials when subjected to plastic deformation. The model was used to study the flow patterns and energy requirements for ten commercial forging shapes and seven commercial extrusion shapes. Photographs of flow patterns, at selected cross sections, and stress-strain curves of plastic deformation were obtained. A major part of the problem was devoted to proving that in the range of plastic deformation certain wax materials behave much like metal alloys.

The research embodied a comprehensive approach to the study of plastic deformation and was unique in that the forging and extrusion stocks were wax material and the forming dies were made of plexiglass. Wax stock was plastically deformed in a special testing machine equipped with an SR-4 strain gauge. It was connected to a Sanborn Tape Recorder, which measured the strain during the deformation of wax specimens. A precise quantitative study of forging energies, under selected experimental parameters was obtained.

Analysis of the results showed that the flow patterns and energy requirements of plastic deformation were analogous to those found in the flow of a viscous liquid. A favorable relationship of characteristics during plastic deformation was found to exist among wax, steel, and aluminum.

This model for studying the plastic deformation of crystalline materials was found to be accurate and reliable in predicting both the flow patterns and stress-strain curves for metal alloys. Die designers, engineers, and educators

should find the model to be useful in solving problems related to the plastic deformation of crystalline materials.

252 pages. $3.15. Mic 56-803

ENGINEERING, MECHANICAL

PREDICTION OF COMPRESSIBILITY OF NATURAL GAS MIXTURES BY THE USE OF AN EQUATION OF STATE

(Publication No. 15,846)

Jui Sheng Hsieh, Ph.D.
The Ohio State University, 1955

In view of the fact that accurate means of predicting compressibility of natural gas are lacking, it has long been a goal of research engineers within the industry to find some method of correlating accurately the pressure-volume-temperature properties of natural gas mixtures over a wide range of pressure and temperature. The tentative standards as set forth by the Natural Gasoline Association of America and the California Natural Gasoline Association are either inaccurate or limited to relatively low pressures. Using Dunkle's proposal, Zimmerman and Beitler have presented a new method of predicting compressibility. This method is simple and accurate for most natural gases and is being adopted by the American Gas Association as the new standard for the natural gas industry. It is unfortunate, however, that this new standard method is unable to predict with sufficient accuracy the compressibility of natural gas mixtures having high ethane and/or nitrogen content.

In this work a new method of predicting compressibility of natural gas mixtures is proposed in which an accurate equation of state is used as the basic tool. Since natural gases are essentially mixtures of light hydrocarbons and the equation of state proposed by Benedict, Webb, and Rubin was empirically designed for such substances, this equation was chosen as the basic equation. Slight adjustments of the constants in the equation of state for ethane have been made so that it will represent the pressure-volume-temperature relationships of gaseous ethane more closely at temperatures not too far above the critical. Because constants of the equation of state for gaseous carbon dioxide were not available, they have been evaluated according to the stepwise procedure described by Benedict, Webb, and Rubin.

Modified rules for combining the constants of the individual gases to obtain constants for the mixture to use in the same equation of state have been proposed empirically for methane-ethane and methane-nitrogen mixtures, which, in effect, govern the behavior of natural gases having high concentration of ethane and nitrogen. Detailed comparisons between the present modified rules for combining constants and those proposed by other investigators are made. Detailed comparisons between the American Gas Association's new standard method and the equation of state method, in which the present modified rules for combining constants are used, are also given for these binary mixtures.

A method of combination of constants in the equation of state for natural gas mixtures has been established empirically. Eight different methods of combining constants have been studied. The present proposed method gives the lowest over-all average deviation. Detailed comparisons between the new standard method of the American Gas Association and the equation of state method, in which the present proposed rules for combining constants are used, are presented for five typical natural gas mixtures, for temperatures ranging between 500 and 640 degrees Rankine and for pressures up to above 3000 psi. The equation of state method gives an over-all absolute average deviation in compressibility factor of 0.18 per cent, while the American Gas Association's new standard method gives 0.32 per cent.

Although the present proposed method of predicting compressibility is accurate and useful, the use of the method by mathematical computation is very time-consuming. In order to reduce the time required to handle this method, a system of graphical solution has been established. A total of seventeen large alignment charts are presented: the first eight charts are for the evaluation of constants for natural gas mixtures, and the rest are for the solution of the Benedict-Webb-Rubin equation of state.

219 pages. $2.74. Mic 56-804

THE VISCOSITY OF STEAM

(Publication No. 15,403)

Thomas Woodrow Jackson, Ph.D.
Purdue University, 1949

Major Professor: Dr. G. A. Hawkins

The dynamic viscosity of steam was determined by means of an annulus type viscosimeter. The viscosimeter consisted of two concentric tubes of 18-8 stainless steel with a clearance between the I.D. of the outer tube and the O.D. of the inner tube of approximately 0.005 inches. The O.D. of the inner tube was 0.3025 inches and the test length of the viscosimeter was 4 inches. Entrance and exit calming sections made pressure drop end corrections unnecessary. The pressure drop across the test section was obtained by radiographing a stainless steel manometer filled with mercury.

Data are reported for tests on steam for pressures up to 1550 psia. and temperatures up to 1115°F.

For pressures up to 1550 psia. and temperatures up to 1115°F the following formula will give the viscosity of superheated steam with an error of less than 7 per cent.

$$\eta = \left[6.00 \times 10^{-9}\right] \tau^2 + \left[7.29 \times 10^{-6}\right] \tau + \left[5.40 \times 10^{-3}\right]$$

η is in centipoises and τ is in degrees Rankine.

76 pages. $1.00. Mic 56-805

THE WORKS OF GIROLAMO SAVOLDO (VOLUMES I AND II)

(Publication No. 14,988)

Creighton Gilbert, Ph.D.
New York University, 1955

This study is designed as a complete monograph on one of the very few important artists of the Italian Renaissance on whom no book has ever been written. As a first study, it inevitably included an exhaustive compilation of materials, as well as an attempt at critical synthesis.

I. The Known Person. Starting from the concrete facts of biography, the relatively small number of documents is reported. Since they are in various cases ambiguous, systematic efforts to derive all their possible implications are required, while evidence from style from the later chapters is used to try to fill in some gaps. The documents themselves are presented in an appendix.

II. Canon and Chronology. Starting from the works which are signed, documented, reported in early guidebooks etc., and the pendants, variants etc. of all of those, detailed Morellian analysis is used to group the works in order and to determine what attributions are correct. Thus the works are not considered in sequence of time but of certainty. Thirty-six paintings and twelve drawings are presented, two paintings and two drawings for the first time, and three new inscriptions of date or signature. Illustrating that the Savoldo canon is in good shape, only one painting is included which has been denied to Savoldo after once being claimed as his. The chronology, however, is far less settled in previous study. An appendix includes a catalogue raisonné, and all available data on lost works.

III. The Literature on Savoldo. Continuing the organization of existing data after the biographical facts and the paintings, the writing about Savoldo is reported in the following main stages: to about 1650, the sources. 1650-1870, the dark ages, in which the tradition of Savoldo's authorship was lost for all but four or five works, and he was little discussed. 1870-1900, the reconstruction of the canon through matching of variants, noting of signatures, and attribution. To 1914, scouring of minor collections, provinces, etc., to add more works. 1920-35, broad critical characterizations and attention increased in general works. Around 1939, the Brescia exhibition and its echoes. Finally, the current position. An appendix contains the bibliography.

IV. Savoldo's World of Style. A definition of his evolving vocabulary. Cima is proposed as his teacher, and his general source as in a Venetian but conservative and non-Giorgionesque area, in which solid figure is set off against open space, without the atmospheric penetration of classic Venetian style. In his evolution Savoldo constantly reduces this opposition but never abolishes it, making figure and space congruent instead of opposed but still separate. In successive stages he modifies his modelling, space and color in these ways. Among the artists who had an effect on him are Leonardo, Titian, Lotto and (late) Moretto. He has a complex parallelism with northern Italianate painters such as David and Mabuse. His slight influence, on Bassano, Caravaggio and Saraceni is suggested.

V. Associated Iconographic Problems. Six separate studies which could not fit in sequence. Several show that two dispersed works are pendants, aiding in chronology and exploring the themes thus presented. Another identifies four self-portraits and their implications. Another surveys Savoldo's preferences in subjects, for passivity in narratives and activity in portraits, meeting in the middle.

VI. False Attributions. Over a hundred entries, nearly all of attributions made since 1920, with suggestions in the majority of cases for another positive attribution. This section should help to avoid rejection of the study on the ground that other works should have been included.

528 pages. $6.60. Mic 56-806

ABSTRACT-EXPRESSIONIST PAINTING IN AMERICA: AN INTERPRETATION BASED ON THE WORK AND THOUGHT OF SIX KEY FIGURES

(Publication No. 15,649)

William Chapin Seitz, Ph.D.
Princeton University, 1955

"Abstract Expressionism" is a term which has been applied to the direction taken by modern art in America since the Second World War. The present interpretation is based on the works and thought of six leading painters: Willem de Kooning, Arshile Gorky, Hans Hofmann, Robert Motherwell, Mark Rothko, and Mark Tobey.

Contemporary art in America developed through an interplay between native Realism and European modern art. By 1950, however, Realism gave ground; more and more painters were working in abstract styles with international origins. Though intensely personal, their works shared common characteristics which showed connections with virtually all of the earlier European movements: Impressionism, Postimpressionism, Expressionism, Cubism, Dadaism, Surrealism, and geometric abstraction. At once radical and synthesizing, this phenomenon cannot truly be called a "movement," for no rallying labels were adopted, and no manifestoes were written. It was effected by combining the discoveries of Cézanne, Cubism, and the abstract painters with the free brushwork of Expressionism, automatism, and the calligraphy of China and Japan.

Though literal representation and story-telling were repudiated, a high value was placed on subject matter, raising the problem of reconciling human and natural content with abstraction. Chief among the formal communities was the "picture plane" — an assertion of flat surface, sometimes for itself, but more often in tension with depth;

flattening or fragmenting bulk, filling void, and thus facilitating a flatness-depth vibration. Movement also took form in the perceptual variability of juxtaposed elements, the rhythmic gestures by which pigment was applied, and the natural qualities of the medium itself. The painting was seen both as an emotionally-charged "object" and as a structural unity, or Gestalt. Incomplete in itself, it was regarded as consummated only in interaction with the spectator's sensory and emotional response. In spirit, organic process was the keynote, involving an intense identification, varying from artist to artist, with "man" and "nature," a love of freedom, and a corresponding rejection of mechanism, determinism, or any subjection of art to absolute rules, political dogma, or utilitarianism. The aesthetic had a goal, only possible through a high degree of abstraction, of inclusiveness — the need to encompass multiple dualisms and levels of existential, rational, and mystical experience within a reciprocal unity suggesting the "yin-yang" concept. Along with this went an urge to centrality — an impulsion toward an intuited core of truth and reality; an absolute, but one which stops short of a static focus.

These ideas and formal criteria were concentrated in New York City during the early forties, the outcome of a confluence of diverse forces, among them increased knowledge gained through exhibitions, travel, reproductions, and literature; a new consciousness of the Orient, and the presence of European masters in America. To a marked degree, the new "Expressionist" component reflected the tension of the New York environment. Cultural cross-fertilization offered the conditions for implementing a very American originality, often pugnacious and anti-traditional.

During the years from 1940 until 1947, Abstract Expressionism was a true advance guard, but by 1954 it had elicited the support of art journals, museums, and university art departments. The styles of established painters in other idioms were influenced, younger men turned to it directly, and to the youngest it provided the basis for a "return" from abstraction to the figure or nature. A small nucleus had become a national and international style.

The content of this development, separated from its pictorial form, can be seen as the cultural parallel of a broad pattern in Western thought seeking to replace the materialism, pragmatism, and collectivism of modern life with both a greater individual integration and a deeper human community. 525 pages. $6.56. Mic 56-807

FOOD TECHNOLOGY

A STUDY OF A FAT-PROTEIN COMPLEX IN POWDERED MILK

(Publication No. 15,656)

Irving I. Litman, Ph.D.
State College of Washington, 1955

Defects peculiar to whole or partly skimmed milk powder are rapid deterioration of solubility and the appearance of an insoluble material, called "scum" which clings to the wall of the container holding milk reconstituted from the powder. Since fat and protein are involved in the development of these defects, the possibility of the formation of a fat-protein complex in milk powder was investigated.

The approach used in this problem was to isolate and analyze the insoluble fraction in milk powder manufactured and stored under different conditions. For this purpose, milk reconstituted from different powders was centrifuged and the fat and protein content of the "skin," which formed on the surface of the centrifuged milk was determined. In addition, chemical analyses of scum adhering to the walls of containers holding reconstituted milk were made. The free-fat content of milk powder was also determined as a possible source of information regarding the nature of the insoluble material.

It was found that there was a rapid decrease in the free-fat content of milk powder during storage at 85° and 100°F., whereas there was no appreciable change in free-fat content during storage at 45° F. It was postulated that the decrease in free-fat was due to the formation of a complex composed of free-fat and protein. The decrease in free-fat was found to be associated with an increase in the moisture content of the milk powder stored at 85°F. ($P<0.01$) but not at 45°F. Free-fat was directly related to the total fat content of the powder ($P<0.01$) and inversely related to homogenization efficiency ($P<0.01$).

The amount of fat found in the surface skin of reconstituted and centrifuged milk was, with few exceptions, lower when the milk powder was stored at 85°F. than when held at 45°F. It was postulated that the decrease in fat content of the skin, as a result of high storage temperature, was due to the formation of a fat-protein complex involving the free-fat. The amount of protein found in the surface skin was directly related to the intensity of preheat treatment ($P<0.05$).

It was found that scum formation occurred only in milk powder containing fat and progressively increased during storage at 85°F., particularly in high fat powder. Storage at 45°F. effectively retarded its development. The protein content of scum remained relatively constant (34.0 per cent) when powder was stored at 85°F., and was not appreciably affected by the composition of the milk powder. It was concluded that scum isolated from powder held at room temperature and above represented the insoluble fat-protein complex.

The amount of casein plus denatured whey protein-nitrogen found in scum (approximately 91 per cent of the total nitrogen) was directly related to the intensity of the preheat treatment. Also, scum was found to be extremely unstable, on the basis of the alcohol stability test. It appeared, therefore, that preheat treatment altered the milk protein in such a way that during storage at room temperature or above it combined with fat to form a fat-protein complex. The high calcium content and high calcium to phosphorus ratio in scum indicated the presence of a calcium caseinate — $Ca_3(PO_4)_2$ complex.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

Fat isolated from scum was found to have a higher melting point and was more saturated than non-scum milk fat. This high-melting point fat may be due to oxidation or may be similar to the high-melting triglyceride fraction isolated by several workers from fat globule membrane.

102 pages. $1.28. Mic 56-808

GEOLOGY

GEOLOGY OF A PORTION OF THE NORTH FLANK OF THE UINTA MOUNTAINS IN THE VICINITY OF MANILA, SUMMIT AND DAGGETT COUNTIES, UTAH, AND SWEETWATER COUNTY, WYOMING

(Publication No. 13,658)

George Gibbs Anderman, Ph.D.
Princeton University, 1955

The pre-Cambrian Uinta Mountain group was deposited in an east-west trough. Its upper unit is correlated with the Red Pine shale, the lower unit with the Mutual formation. The group is overlain disconformably by the Madison limestone. The Middle Cambrian shoreline lay to the west of the area, the Upper Cambrian shoreline to the east. Whether Upper Cambrian sediments were deposited in the area and subsequently removed is not known. The Manila area was a low-lying land area from Ordovician through Devonian time. The Mississippian and Pennsylvanian formations and their depositional history are related to epeirogenic and orogenic activity of the Ancestral Rocky Mountains and epeirogenic uplift in northern and western Wyoming. Disconformities probably separate Mississippian-Pennsylvanian and possibly Pennsylvanian-Permian rocks. Three members of the Park City formation are recognized in the Manila area.

With probable continuous deposition from Permian into Early Triassic time, shallow-water deposition of the Woodside formation is postulated. The Stanaker formation is probably terrestrial. The Jurassic System is represented by the Navajo, Carmel, Entrada, Curtis, and Morrison formations in the Manila area. Deposition was probably continuous from Jurassic into Lower Cretaceous time, and it is suggested that the deposition of the Burro Canyon (?) formation in the Manila area is related to the Cedar Hills orogeny to the west. The Burro Canyon (?) and Dakota (?) formations and the Mowry shale are Lower Cretaceous. The Upper Cretaceous consists of the Frontier formation, Baxter shale, and Mesaverde group. The disconformity between the Mowry and Frontier and the thin Frontier in the area are related to crustal instability. Transitionally overlying the Frontier, the marine Baxter shale interfingers with the overlying Mesaverde.

The Hiawatha and Cathedral Bluffs members of the Wasatch formation are extended into the area. Considered Paleocene and Early Eocene, the Hiawatha, overlying the Mesaverde disconformably, is fluviatile, deposited partly in a swamp environment. Early Eocene in age and transitionally overlying the Hiawatha, the fluviatile Cathedral Bluffs is red-banded and contains coarser clastics than the Hiawatha. The association of coarser clastics with red coloration in the Cathedral Bluffs is considered a reflection of increasing orogenic activity which reached its climax during early Medial Eocene time and the deposition of the Green River formation. Locally derived cobbles and boulders present in the Green River formation were probably deposited as a series of coalescing fanglomerates in a lacustrine environment and along the narrow margin that probably existed periodically between the edge of the lake and the mountains. Transitionally overlying the Wasatch on the east side of the Green River, the Green River formation becomes involved in the Henry's Fork fault on the west side of the Green River, and westward an intraformational angular unconformity is developed with the Green River formations. This angular discordance within the formation, present only where the formation laps highest onto the flanks of the Uinta Mountains, disappears rapidly basinward. East and west of Phil Pico Mountain, a portion of the lower part of the Green River formation is overridden along the Henry's Fork fault. The remainder of the lower part of the Green River formation, the Henry's Fork fault, and Mesozoic rocks are overlapped by the upper part of the Green River formation. The formation is overlain transitionally by the fluviatile and locally lacustrine, volcanic-rich sediments of the Bridger formation.

The active orogenic history of the Uinta Mountains probably began at a later date than that of the Wasatch Mountains and the folding and thrust faulting in western Wyoming occurred prior to the major period of deformation of the Manila area. The major period of deformation of the area during early Medial Eocene time resulted from east-northeast to northeast directed compressional forces with the resultant movement predominantly vertical. The western termination of the Uinta fault occurs in the Manila area; but, as the displacement of the Uinta fault decreases westward to zero, displacement along the Henry's Fork fault, which originates in the area, increases.

The post-Eocene geomorphology of the north flank of the Uinta Mountains is discussed. The drainage of the Green River Basin may have been southward into the Uinta Basin since Medial Eocene time. Later Tertiary history included the collapse of the eastern end of the Uinta Mountains. Quaternary erosional forms and sediments are also described and discussed. 658 pages. $8.23. Mic 56-809

THE PARALLEL RADIUS METHOD OF SOLVING THE INVERSE SHORAN PROBLEM

(Publication No. 15,828)

Clair Eugene Ewing, Ph.D.
The Ohio State University, 1955

The shoran (short-range navigation) system was developed during World War II as a blind bombing device. Since 1945, it has been adapted to electronic surveying. A shoran system consists of two ground radar stations and one or more air-borne radar stations. The distance from each ground station to the aircraft is obtained as a function of the elapsed time for the radio signal to negotiate the round-trip distance.

There are two general types of shoran operations: (1) the direct case, in which the shoran dial reading, the aircraft altitude, and other pertinent data are photographed on recorder film and the data subsequently reduced to the geodetic distance, and (2) the inverse case, in which the geographic coördinates and altitude of ground station and aircraft are furnished while the corrected shoran dial setting is desired. It is a solution to this second problem which is discussed herein.

In the past, a variety of computational methods have been used, some based on geographic coördinates, some on Universal Transverse Mercator coördinates, and others on geocentric space rectangular coördinates. Wishing to combine to the utmost the virtues of speed, accuracy, simplicity, and dependability, the author has developed a new approach which he has designated the "Parallel Radius Method." The procedure for the distance determination may be divided into three steps.

Step 1: Given the geographic coördinates of two points on the reference ellipsoid, determine the length of the chord which joins these two points. This problem has been simplified by considering a trapezoid within the ellipsoid whose corners are located at the following four points: φ_1, λ_1; φ_1, λ_2; φ_2, λ_1; and φ_2, λ_2. The sides, and subsequently the diagonal, of this trapezoid can be computed simply from the standard x and y coördinates of the two points. To this end, a table has been prepared giving the x and y coördinates in statute miles for each minute of latitude from equator to pole. The diagonal of the trapezoid represents the chord of the reference ellipsoid joining the two points.

Step 2: Having obtained the chord of the reference ellipsoid, compute the length of the chord of the shoran ray path. In this step, the earth is assumed to be a sphere. Two radial lines are drawn from the center of the sphere, one through the air-borne station and one through the ground station. Two additional lines are drawn parallel to the chord obtained in step 1, one through the ground station and one through the air-borne station. It is obvious that these four lines intersect to form a trapezoid in space, all four sides of which are obtainable from known data. The diagonal of the trapezoid is the chord of the shoran ray path.

Step 3: Convert the chord of the ray path to the shoran dial setting, allowing for both geometric and velocity corrections. To the ray-path chord distance, two corrections must be applied. One is a geometric correction to account for the change from the chord to the arc. It is readily derivable as a chord to arc series expansion. The other correction is due to the increase of velocity of radio propagation with altitude. The combined geometric-velocity correction is tabulated for shoran distances up to 300 miles in length.

The azimuth from the target to ground station is required to an accuracy of ± 36". A modification of Rudoe's equation furnishes a convenient solution, although an alternate solution is presented also.

As a by-product of the parallel radius method of inverse shoran computation, a method of performing the inverse geodetic computation is presented. It gives distance and direction accuracies acceptable in many geodetic operations.

237 pages. $2.96. Mic 56-810

GEOLOGY OF THE LORDSBURG QUADRANGLE, HIDALGO COUNTY, NEW MEXICO

(Publication No. 15,721)

Robert Frederick Flege, Jr., Ph.D.
Washington University, 1956

Chairman: James C. Brice

The Lordsburg quadrangle is located in southwestern New Mexico in that part of the Basin and Range Physiographic Province known as the Mexican Highland. The main relief feature of the quadrangle is the Pyramid Mountains, a linear, north-south range about 22 miles long and ranging from 3 to 7 miles in width. The range is bounded on all sides by flat desert basins filled with alluvium.

The indurated rocks exposed in the Pyramid Mountains are all of igneous origin, and both intrusive and extrusive types are represented. Nowhere are indurated sedimentary rock outcrops found, although Cretaceous or Paleozoic sediments are probably present at shallow depth near the south boundary of the area. Field relations in the Lordsburg quadrangle indicate that there were four main periods of volcanic activity and two main periods of intrusive activity.

The earliest period of volcanic activity is recorded by about 2000 feet of dark gray to red basalt flows which, on the basis of investigations made in the Little Hatchet Mountains 35 miles to the south, are presumed to be Lower Cretaceous. The intrusion of plugs of breccia and rhyolite into the basalt probably marked the close of the earliest period of volcanic activity. In late Cretaceous or early Tertiary time, these Cretaceous basalts were intruded by a stock of granodiorite (which represented the first main period of intrusive activity), and the mineral veins of the Lordsburg mining district were formed.

Following a period of erosion, a sequence of about 1000 feet of andesitic flows and breccias were erupted in early Tertiary time. A basal agglomerate of this sequence contains large boulders of the Cretaceous basalt, blocks of pre-Cambrian granite, and huge blocks of Pennsylvanian Magdalena limestone. Following the eruption of this sequence, the andesites were intruded by a small monzonite stock (which represented the second main period of intrusive activity) in early Tertiary time.

After a rather long period of erosion, an episode of violent explosive activity resulted in the accumulation of 2000 to 2500 feet of volcanic rocks, including rhyolite flows, tuffs, tuff-breccia, welded tuff and basalt, and several layers of vitrophyre. The activity probably took place during

middle to late Tertiary time. Toward the close of this episode, the glass-cored volcanic dome of the Leitendorf Hills was formed. Quartz latite dikes and plugs were then emplaced.

After regional tilting to the northeast, the latest period of volcanic activity ensued with the formation of about 500 to 600 feet of rhyolitic flows and breccias, probably derived from the volcanic necks of North and South Pyramid Peaks. Following the extrusion of these flows and breccias, rhyolite dikes and plugs were injected into the country rock.

The structural geology of the quadrangle is characterized by regional tilting and high angle faulting. Evidences of intense compression are lacking, although one broad, gentle anticline was mapped at the south end of the area.

The petrogenesis of the volcanic rocks of the Lordsburg quadrangle is not attributed to simple fractional crystallization of a primary basaltic magma because: 1) the great volume of rhyolitic and andesitic material relative to the small volume of accompanying basalt is anomalous; 2) the interbedded nature of widely different types of flows suggests independent origin and uprise of two kinds of magma; and 3) the mineralogical peculiarities of the volcanic rocks of the Lordsburg quadrangle suggest mixing of magmas rather than straight differentiation of a primary basaltic magma. The origin of the great volume of andesitic and rhyoltic material is tentatively attributed to partial or complete fusion of rocks of varied composition beneath or within the sialic layer (with the generation of andesitic and rhyolitic magmas) where downward thickening of the sialic layer accompanied folding. If folding is active, segregation of magmas and mixing and blending of magmas en route to the surface may be possible.

92 pages. $1.15. Mic 56-811

PLEISTOCENE GEOLOGY OF THE BECANCOUR MAP-AREA, QUEBEC

(Publication No. 15,207)

Nelson Raymond Gadd, Ph.D.
University of Illinois, 1955

The Bécancour map-area, east of Three Rivers and about 110 miles downstream from Montreal, is the site of the first unit-area stratigraphic study of Pleistocene deposits in the central part of the St. Lawrence lowland. The geology of a larger area including the Bécancour and adjoining Three Rivers, Yamaska, Aston and Upton areas is represented by that of the Bécancour map-area.

A summary of literature pertaining to the central part of the lowland indicates that some published conclusions are based on insufficient observations, some of which are misinterpreted. As a result previous reports of Pleistocene history are inadequate and misleading. In this report detailed description of physical features and of the sediments, illustrated by photographs, identifies the environments of deposition of the unconsolidated sediments; columnar sections illustrate the order of superposition of the sedimentary units and the chronology of Pleistocene events. From this is derived a simple Pleistocene stratigraphy.

Pre-Wisconsin (Illinoian?) glaciation is represented by red pro-glacial varves deposited in bedrock channels and by slightly younger red till deposited by overriding ice. Pebble orientations indicate southward to south-southwestward movement; the southern limit of this glaciation is not known.

The St. Pierre Interglacial Interval followed the red till glaciation. This was a period of fresh-water deposition in a system resembling the present St. Lawrence drainage. Its moist climate was cooler than that of the present, but warmer than that of Two Creeks time. Extensive, thick deposits of peat and wood laid down towards the end of the interval constitute the key stratigraphic unit of the region. Their age is probably greater than 40,000, C_{14} years (W-189); thus the peat and wood are older than any known Wisconsin deposits and therefore are late Sangamon or older.

Deposition of gray glacial varves in the valleys eroded during St. Pierre time closed the interglacial interval and initiated a second glacial epoch. An ice sheet moving southward to southwestward overrode the pro-glacial lake and deposited a calcareous sandy gray till over most of the area. It occupied the St. Lawrence Valley through most of Wisconsin time. The southern limit of the gray till is the Drummondville moraine. This moraine extends in an arc from St. Apollinaire, near the Quebec Bridge, through Drummondville to Yamaska Mountain and beyond, trending towards Covey Hill. Because of its stratigraphic relationships to subjacent St. Pierre sediments and superjacent Champlain Sea sediments, this gray till and the glaciation it represents are dated as Wisconsin, and correlation with the Mankato is suggested.

Retreat of the ice front from the Drummondville moraine was followed closely by invasion of the entire St. Lawrence lowland by the brackish waters of the Champlain Sea. Superposition of gray till on fossiliferous marine clay, the existence of the St. Narcisse moraine, and the character of some stratified facies of marine sediments indicate a late-glacial re-advance of ice into the northern part of the marine basin.

Several facies of marine sediment record a single marine episode in the central part of the St. Lawrence lowland. Recession of the marine waters from their highest levels in the Bécancour area was a relatively rapid, continuous episode. Conditions changed from marine to estuarine and culminated in fluvial conditions now represented by the youthful drainage system of the St. Lawrence River.

215 pages. $2.69. Mic 56-812

HEALTH SCIENCES, PUBLIC HEALTH

REPRODUCTIVE POTENTIAL, LIFE SPAN, AND WEIGHT OF HOUSE FLIES, MUSCA DOMESTICA L. SURVIVING INITIAL EXPOSURE TO AN INSECTICIDE

(Publication No. 15,905)

Saad El Din Afifi, Ph.D.
Kansas State College, 1956

It has been suspected that an increase in the population of house flies may accompany the establishment of resistance to insecticides. This investigation was concerned with the effect of a single insecticidal treatment upon the parent and first three filial generations.

The NAIDM strain, with no history of insecticide exposure, was used. When three to four days old, one group was retained without treatment and the other treated with dieldrin, in acetone solution, applied to the thorax by a calibrated micro-loop at a dosage of 2 microgm./gm. of flies, which produced a mortality of 60 to 90 per cent.

After two days, during which time all discernible mortality had occurred, surviving flies were separated into replicated lots of ten females and six males each. The untreated flies were replicated in like manner.

Eggs from each replicated lot were removed daily to jars containing NAIDM standard larval medium and the ensuing adult flies were counted. Eggs laid in the fifth and the sixth day after the initial mating served as breeding stock for subsequent generations.

Treated parent females produced adult offspring at the rate of 5,594 per 100 females as compared to 4,795 by the controls, or a 16.7 per cent increase. During the first 13 days after initial mating, the F_1 generation of the treated parents produced at the rate of 18,361 adult progeny per 100 females as compared to 10,816 adult progeny of the F_1 descendents of the untreated parents, or a 69.2 per cent increase. A laboratory mishap prevented measurement of reproduction after the thirteenth day but the great majority of oviposition is completed by the thirteenth day. The F_2 generation of the treated parents produced adult offspring at the rate of 16,688 per 100 females as compared to 15,268 in the untreated group, representing a 9.3 per cent increase. The F_3 generation of the treated parents produced 8,569 adult offspring as compared to 9,716 in the untreated, a 13.4 per cent difference.

A statistical analysis of variance indicated no significant difference in number of adult progeny of the treated and untreated parents. This does not necessarily indicate that a significant difference would not occur under normal life history conditions, however, since it was necessary to postpone mating 5 to 6 days, a substantial part of the reproductive life, in order to allow time for the flies to age and also time for some to succumb to the insecticide. A significant difference did occur in the F_1 adult progeny, but a reversion back to normal reproduction took place in the F_2 and F_3 generations, since no significant difference was found in these.

Although the life span was longer in the parents as well as in the F_2 and F_3 generations of the treated group, statistical analysis of variance showed no significant difference, based upon average life span of the females. The same was true when comparing relative length of oviposition period. Relative weights after death were likewise insignificantly different, except in the F_2 generation in which the treated group was significantly heavier.

Linear correlation was found between the weight of the treated parent females and the number of progeny produced by these females. However, this correlation was not significant in the first, second, and third generation of the treated group; also it was not significant in the untreated parent females and their three generations. The correlation between length of life and the average weight was not statistically significant in either the treated or the untreated parents, and their respective generations. Correlation between length of life and the number of progeny produced was not statistically significant in any respect.

48 pages. $1.00. Mic 56-813

HISTORY, ANCIENT

THE PUBLIC PHYSICIANS OF ANCIENT GREECE

(Publication No. 15,734)

Louis Cohn-Haft, Ph.D.
Columbia University, 1955

There are allusions in literature and in inscriptions to physicians having an official connection with one Greek polis or another. These doctors, frequently referred to by the distinctive appellation demosieuontes, are the public physicians. References to them are concentrated in the Hellenistic period.

Previous study has resulted in the generally accepted position that these physicians were hired by the city-states for the purpose of providing medical care free of charge; and the comparatively numerous references in the honorary decrees of the Hellenistic period have led to the envisaging of a thoroughly institutionalized "Health Service" universally in existence in that period.

This view, which ultimately goes back to the pioneering work of A. Vercoutre in successive fascicles of the Revue archeologique for 1880, is founded upon the definitive study by Rudolf Pohl, De Graecorum medicis publicis, published in Berlin in 1905.

The function of free medical care rests upon a single source, and this is shown in the present work to be extremely unreliable. Analysis of all other relevant information, including a consideration of the status of the medical profession and the conditions of medical practice as well as of the prevailing social attitudes and institutions, confirms this and demonstrates on a number of grounds the great difficulties in the way of the usual interpretation. It is shown to be entirely improbable that the public physicians represent an institution of social welfare such as has usually been envisaged, or that they were anywhere employed for the specific purpose of furnishing medical care gratis.

Although complete uniformity is not to be found (nor to be expected) in the purpose and function of the men called "public" physicians in the various poleis where they are found, their retention and the payment to them of a comparatively modest annual stipend are shown to be in most instances simply an expedient adopted to compensate for a shortage of trained physicians by guaranteeing the residence of a physician in a locality which could not otherwise be certain that medical care would be at all times available to its inhabitants. The physician contracted to remain in the city for the specified period, there to practice medicine, charging fees for his services just as any private practitioner did. In the case of such a city as Athens, where no shortage obtained, an exhaustive analysis of the sources shows that a "public physician" may have been one who received the official endorsement of the polis in regard to his qualifications to practice medicine.

The underlying argument of the work is that the analysis of social institutions must be carried out within a broad historical framework and that coincidence of terminology (and especially of titulature) can never be decisive in such matters. In a final chapter the errors into which previous scholarship has been led as a result of failure to recognize this fundamental principle are exposed. This is done through an examination of a number of peripheral topics that have heretofore been indiscriminately confused with the problem of the public physicians in the Hellenistic cities. These topics include: the medical system of Ptolemaic Egypt, the medical tax, military medicine, the organization of medical service in the Hellenistic kingdoms, the public physicians of Roman Egypt, and the organization of the medical profession in the Roman Empire.

225 pages. $2.81. Mic 56-814

HISTORY, MODERN

JOHN WINTHROP, JOHN WINTHROP, JR., AND THE PROBLEM OF COLONIAL DEPENDENCY IN NEW ENGLAND, 1630 - 1676: A STUDY IN CONTRASTS

(Publication No. 13,686)

Richard Slator Dunn, Ph.D.
Princeton University, 1955

This study attempts to analyze, by way of the biographical method, the New England colonists' attitude toward the mother country during the first fifty years of settlement. Since the New England Puritan colonies were initially hostile to the government of Charles I and acted almost like independent states, and since as the century progressed the home government grew able to supervise its foreign plantations more effectively, the question is: how did the New Englanders adjust themselves to these changing circumstances? As they discovered the economic and military advantages of close liaison with the mother country, how fully did they enter into partnership in the emerging British imperial system? As the religious fervor which had initially animated their hostility to the Stuart government faded, how much of the initial independent attitude did they retain?

The purpose here is to investigate the degree of change in attitude toward the mother country between the first and second New England generations. This is done through a dual biography of two central figures: John Winthrop, Governor of Massachusetts, and his son John Winthrop, Jr., Governor of Connecticut. This study therefore stands or falls on a double proposition: (1) that the elder Winthrop was the chief architect of New England's policy toward the mother country between 1630 and 1649, while his son played a role of roughly equivalent importance in the 1660's and 1670's, and (2) that both these men represented to a significant extent the distinctive traits of their respective

generations. To substantiate this proposition their careers are presented in detail, with special emphasis on their attitudes and actions toward England.

The first two chapters describe Massachusetts' policy toward England in the 1630's and 1640's, under the elder Winthrop's leadership. Here it is asked how far Winthrop and his colleagues were willing to carry their break with Stuart England, how different their attitude was toward Charles I in the 1630's and Parliament in the 1640's, the relation of the Antinomian controversy and the Remonstrant controversy to Massachusetts' independence from England, and the significance of Massachusetts' imperialistic tactics toward Rhode Island and toward the French in Acadia in the 1640's. The third chapter is the pivotal one, taking up the younger Winthrop's industrial projects, suggesting reasons for their failure, and emphasizing John Winthrop, Jr.'s role as representative of the businessman's viewpoint, an increasingly significant viewpoint in seventeenth century New England. The last two chapters then trace the younger Winthrop's career as governor of Connecticut, his involvement in land claims and boundary disputes, particularly in Narragansett Bay, where his father had also intervened, but for religious and not material reasons. His attitude toward Cromwell and the Restoration are discussed as background for his trip to England to get the Connecticut charter of 1662. Finally his efforts at cooperation with the Royal Commission of 1664 and with the ducal governors of New York, and his troubles with Governor Andros, are described.

Father and son are presented here side by side, in conscious contrast. It is emphasized that they were different sorts of men, dealing with very different sets of circumstances, and thus their policies toward England were significantly different. It is concluded, however, that the contrast should not be overdrawn, for the attitudes of these two men and of the first and second generation New Englanders in general toward the home government did not fundamentally change very much. The initial attitude of independence was in large measure retained. The colonists of the second generation began to accept a degree of colonial dependency, but only the rewards and not the penalties of colonial status. 507 pages. $6.34. Mic 56-815

THE FRENCH ACADEMY OF SCIENCES EXPEDITION TO SPANISH AMERICA 1735 - 1744

(Publication No. 15,202)

Robert Finn Erickson, Ph.D.
University of Illinois, 1955

The French Academy of Sciences expedition of 1735 was the first large-scale scientific project of modern times, and as such, it initiated the long series of scientific voyages which has extended to the present.

The 1735 expedition arose directly out of the dispute in scientific circles over the size and shape of the earth, a dispute which involved the leading scientists in England and on the Continent as well. In his Principia, Isaac Newton had theorized that the earth, as a rotating body, would have the shape of an oblate ellipsoid; therefore, its polar axis would be shorter than its equatorial axis. At first, there was general acceptance of Newton's theory, especially as some pendulum experiments performed at Cayenne in 1672 had indicated that the pull of gravity was less there than at higher latitudes.

In the 18th century, however, when the cartographic work on the great map of France had reached an advanced stage, the measurements made along the meridian of Paris indicated that, contrary to the theories of both Newton and Christian Huyghens, the earth was a prolate spheroid, i.e., it was elongated toward the poles. The cartography in France was largely the work of the Cassini family, and they maintained that, since the degrees of latitude in France lengthened as one advanced from north to south, the earth could not be flattened at the poles. After some years of controversy, the Academy of Sciences resolved to send some of its members to an equatorial region in order to make arc measurements, and thus compare the length of the first degrees of latitude with those in France.

The three principal members of the expedition were the Academicians Louis Godin, Pierre Bouguer, and Charles de La Condamine. They were assisted chiefly by Joseph de Jussieu, a botanist, and by a naval engineer named Verguin. There were other Frenchmen in the party, and it was joined in New Spain by two Spanish naval officers, Jorge Juan and Antonio de Ulloa. The region selected for the geodetic work of the expedition was that near Quito in present-day Ecuador. The Province of Quito was then a division of the Viceroyalty of Peru.

The scientific operations of the French expedition consumed many years — years which were marked by internal disputes, sickness, hostility from the local officials, misfortunes with instruments and measurements, and numerous other difficulties. However, the scientists persevered despite a multitude of obstacles, and their arc measurements in the Andean Cordillera proved conclusively that the earth is flattened at the poles. Their work was remarkably accurate for its era and, in addition to the geodetic accomplishments, the Frenchmen and their Spanish associates conducted many experiments in physics and astronomy, and observed much that was new and valuable in the field of natural history.

The record of the expedition has been preserved in the published works of La Condamine, Bouguer, Juan, and Ulloa, and also in the manuscript deposits in the Paris Observatory, Museum of Natural History, and other archives in that city. The author utilized all of these materials in his research. 352 pages. $4.40. Mic 56-816

FROM VANDALIA TO VICKSBURG: THE POLITICAL AND MILITARY CAREER OF JOHN A. McCLERNAND

(Publication No. 15,219)

Victor Hicken, Ph.D.
University of Illinois, 1955

The political and military career of John Alexander McClernand is filled with participation in great movements and events. Early in his life, when a member of the House of Representatives of the Illinois General Assembly, he took part in the initiation of internal improvement schemes for the state; acts which were important to the development of Illinois, but which almost caused bankruptcy of the state

government. Following his successes in Springfield, he moved to Washington as the newly elected Representative of a Congressional district in southern Illinois. While a member of this body, he became a powerful spokesman for the interests of the West, and rose to a point of influence in the administration of President Polk.

After the passage of the Compromise of 1850, and the Illinois Central land grant proposal, McClernand returned to Illinois for the purpose of taking part in land speculation. He returned to public notice in 1854, when he broke openly with Stephen A. Douglas over the Kansas-Nebraska Act. Once again, he became a potent force in Illinois politics. In 1858, he helped Douglas to victory in his senatorial campaign against Lincoln. In 1859, the following year, McClernand returned to Congress. He took part in the bitter discussion over the speakership in 1859 and 1860, almost being elected to the post himself.

With the dissolution of the Union in 1861, McClernand was commissioned brigadier-general in the Union Army. Stationed at Cairo, he came into contact with U. S. Grant, and, together with that General, he took part in the battles of Belmont, Fort Henry, Fort Donelson, and Shiloh. Though coming into early personality conflict with Grant, he felt that his power and prestige were sufficient to warrant an appointment to a separate command. In the fall of 1862, he went to Washington, and, after repeated conferences with President Lincoln and members of his cabinet, he obtained a commission to raise a new army for the purpose of taking Vicksburg. After a brief success at Arkansas Post, Grant superseded him in this command, and relegated him to the charge of the XIII Corps. Throughout this period, McClernand repeatedly intrigued against Grant, and there emerges a bitter personal struggle between the two men. After the failure to take Vicksburg on May 22nd, Grant sent his opponent back to Springfield on indefinite leave on the basis that he had been inept in his duties. McClernand was never able to regain his lost influence, despite his claims that Vicksburg was taken by his plans. He eventually resigned his commission late in the war.

304 pages. $3.80. Mic 56-817

THE DUKES: A STUDY OF THE ENGLISH NOBILITY IN THE EIGHTEENTH CENTURY

(Publication No. 15,849)

Ray Alden Kelch, Ph.D.
The Ohio State University, 1955

The fact that an English noblesse did not exist in the eighteenth century partially explains why no systematic study of the nobility, its attributes and functions, has been made. The study of thirty-one non-royal English ducal titles, represented by eighty-one individuals in the period 1714-1784, is an attempt to rectify this condition so far as available printed sources will permit.

The aristocratic group which largely ruled Britain from 1714 to 1763 was almost entirely Whig and was composed of closely related families. A study of the attitudes and values of this noble class which lived and made the history of England for over fifty years, and of the aristocratic setting in which it lived, gives a better understanding of the functioning of the state in this pre-reform age.

The early chapters of the dissertation treat of the noble class as a whole; they deal with the nobility as holders of landed property and its corollary, political power, as reflected in the peerage, and examine the reasons for, and the practical uses of, peerage creations and the methods of making peers. An assessment is made of the social values of the group as seen in the concept of the gentleman and in the group's financial position, education and marriages, and interest in service to the state. The concept, extent, and effect of noble privilege in the century are also examined. The area of privilege in England was very narrow, for it applied only to the noble himself and not to members of his family, and most of the legal privileges were trifling in themselves. The majority of the privileges sprang from the nobleman's position in parliament and from his ownership of land.

The later chapters of the dissertation are devoted to an examination of the dukes, their titles, political activities and offices, their economic position and interests, and their education, marriages, and social life. These chapters make it apparent that most of the ducal titles were gained as the result of various political services. The dukes appear to have been more active in local than in national politics, for although every cabinet in the period contained at least one duke, representatives of only one-third of the ducal families held high political office. A ducal title had great symbolic value to the Whigs, but it did not automatically bring political influence. The dukes held many offices of trust or honor, lord lieutenancies and sinecures, nearly always through their influence with the Whig Party.

The investments of the dukes in agriculture and commerce and the government positions they held gave them sufficient income to maintain their titles. An assessment is made of the ducal pattern of expenditures for maintaining their titles and families, providing for their children, meeting taxes and debts, paying for legal and other services, and helping dependents. The general habits and interests of the ducal class in town and country and their educational and intellectual interests are explored. A study of the marriages of the dukes, made in an effort to determine the extent of class cohesion, shows that only slightly more than one-half married daughters of noblemen. Thus class consciousness among them was not as great as might be expected. Thus the study in historical sociology reveals how the dukes were representative of political, economic, and social influence in English society in the eighteenth century. 313 pages. $3.91. Mic 56-818

THE IMPACT OF SOVIET POLICIES IN ARMENIA, 1920-1936; A STUDY OF PLANNED CULTURAL TRANSFORMATION

(Publication No. 15,378)

Mary Allerton Kilbourne Matossian, Ph.D.
Stanford University, 1955

The purpose of this study is to examine Soviet policies in Armenia and their impact on the patterns of Armenian culture. Specifically, an attempt is made to evaluate the impact of Soviet policies on the traditional Armenian Church, family, village, and town; to assess the extent to

which the values taught by these institutions were supplanted; and to examine new Soviet institutions and values which took root among the Armenians.

The study is introduced by a survey of Armenian social history and an analysis of the basic institutions and values of Armenian culture prior to 1920. The main body of the study begins with the Sovietization of Armenia in late 1920 and ends with the reorganization of Soviet Armenia as a Union Republic of the U.S.S.R. on December 5, 1936.

The conclusions in this study were reached by analyzing expository and statistical materials.

It was found that the Communists accelerated the breaking up of the extended Armenian family; that they supplanted and supplemented kin loyalties with loyalties to Soviet institutions; and that they succeeded in drawing large numbers of Armenian women into public life. On the other hand, male predominance was retained in the home and in public life. The traditional division of labor between the sexes survived to a large extent in the villages. Nevertheless, the traditional political and economic organization of the village was replaced by that of the collective farm. The town had acquired increased influence in the formation of Armenian values; it had become a center of diffusion for Soviet culture. The Armenian Church had lost most of its political, social, and cultural functions, but it still enjoyed sympathy among the peasants and even within the Armenian government. It was found that the process of secularization of Armenian values was accelerated under Soviet rule. Armenian nationalism was expressed in a variety of forms, despite limitations imposed upon its expression by the Communists.

Soviet policies were resisted most vigorously by the classes against which they discriminated. Those Soviet policies which were most incompatible with Armenian culture were those most vigorously resisted.

It was concluded that Soviet successes in Armenia could be accounted for by (1) the inherent attractiveness of Communist ideology; (2) the policy of recruiting the most able Armenians for the Soviet elite; (3) the efficiency of Soviet institutions; and (4) Communist insight into the character of traditional Armenian culture. Soviet failures were attributed to (1) the failure to transform adequately the basic institutions of traditional Armenian culture during the period 1921-1928 and (2) the suddenness of the impact of the new Soviet policies in the period 1929-1936.

510 pages. $6.38. Mic 56-819

THE NAVAL CAREER OF CAPTAIN HAMOND, 1775-1779

(Publication No. 13,844)

William Hugh Moomaw, Ph.D.
University of Virginia, 1955

Captain Hamond came early to the attention of Admiral Hawke and Lord Howe. Their interest, and that of First Lord of the Admiralty Sandwich, resulted in Hamond being one of the leading naval captains when the American Revolutionary War broke out. He had served on the North American station, 1771-1773, and became well acquainted with the last Royal Governor, Lord Dunmore, also meeting the young George Washington.

In 1775, Hamond was given, unsolicited, the command of H. M. S. Roebuck, 44. After assisting in the defence of Halifax, November-January, 1775-1776, he was ordered by Admiral Graves to take command of H. M. ships in Delaware and Virginia waters. He arrived at Hampton Roads in February, 1776, but his squadron, never more than four warships, was inadequate for blockading both Delaware and Chesapeake Bays, destroying American privateers and fortifications, encouraging the loyalists and defending Lord Dunmore. His arrival, however, effectively stopped Commodore Hopkins from attacking Dunmore with the Continental fleet.

Hamond, at no time in personal contact with either Admiral Graves or Shuldham, hoped to launch an early attack on Philadelphia, in which he was encouraged by American loyalists on the Delaware peninsula. He was in close contact with General Clinton, who had stopped off at Norfolk en route to Cape Fear to join the Southern expedition from England. Until the very moment of its committal against Charleston, Clinton had intended to take it to Virginia.

Hamond then turned his attention to the Delaware. In late February he blockaded the bay with sloops, going there himself in March. In May, he moved up the river to sound out the American defences, but discovered their strength was such as to require a combined operation. When Clinton informed him he was moving against Charleston, Hamond determined to join him, but at the last moment was forced to evacuate Dunmore and the loyalists from Norfolk.

The mid-summer of 1776 was taken up by the defence of Dunmore's floating town, but he cultivated contacts with prominent loyalists in Delaware and Maryland, even distributing his surplus arms and ammunition. His relations with Dunmore were far from satisfactory, and Admiral Shuldham left him quite at liberty. When Hamond heard that Admiral Howe had arrived at New York in July, he decided to join him, overriding Dunmore's protests but supported by Governor Eden of Maryland, whom he had succored.

Under Howe, Hamond prominently participated in naval operations around New York in late 1776, being given the command of another Delaware squadron in December, by which Howe exonerated him from Lord Germain's charge of laxity in the Delaware blockade. As commander of this squadron in the summer of 1777, Hamond became concerned in the strategy of the British campaign that ended with the capture of Philadelphia.

It is now revealed for the first time that Hamond ardently advocated an immediate Delaware landing when he conferred with the Howe brothers, July 30, 1777. This detailed information, which completely lifts from him the responsibility for giving advice that caused the Howes, it has been believed, to move around to Chesapeake Bay, was diametrically opposed to the evidence he gave in 1779 during the Parliamentary Inquiry into the Howes' conduct of the American war. He then defended the Chesapeake landing in the interests of his patron Lord Howe, with the result that after the initial controversy died out, his parliamentary evidence has been cited ever since to show that it was he who was responsible for General Howe's failure to land up the Delaware. 486 pages. $6.08. Mic 56-820

AGRIPPA von NETTESHEIM (1486-1535): HIS LIFE AND THOUGHT

(Publication No. 15,249)

Charles Garfield Nauert, Jr., Ph.D.
University of Illinois, 1955

This study presents the events of Agrippa's life as they influenced his intellectual development, and then expounds the major themes of his thought and the relationships among them. His continual wanderings brought him into touch with many intellectual traditions: Lullian rationalism, scholasticism, Neoplatonism, humanism, magic, and cabala. Personal disappointment in his later years accentuated a pessimism which was present even in his earliest thought. He also read widely. He knew something of all his major groups of sources by 1510 but always continued to seek new materials. His years in Italy aided his study of Neoplatonism and cabala. Yet his chief source for cabala and magic was Reuchlin. Parisian nominalism and Nicholas of Cusa influenced his skepticism. He also refers, probably at second hand, to ancient skepticism.

Agrippa showed much sympathy with the Reformation but never embraced it. His violent anticlericalism is tempered by reservations favoring the institutional church. His attack on rational theology and stress on mystical experience are products of medieval fideism, not of Protestantism. He stresses the Bible but leaves control of interpretation to the church.

Previous explanations of his speculative thought have failed to reconcile the skeptical and the credulous. Except for a brief and early flirtation with Lullian rationalism, he always denied the power of human reason to gain truth. He first escaped doubt by appealing to occult authorities; but he gradually lost faith in these, so that in De vanitate he denounced occultism and rationalism alike. His only conscious escape from intellectual despair was mysticism and trust in the Bible. Yet persistence of belief in sense knowledge, joined to the idea that one may follow any abstract system as long as it is useful, suggests that he was unconsciously moving toward the idea of scientific hypothesis.

The occult world which his early works expound, and which is not entirely absent from his later writings, is above all hierarchical in nature. The magus or illuminated man uses the close sympathetic bonds among its parts in magical operations. The magus is not subject to occult forces but rather uses them for his own ends. Various symbols enable him to attract superior powers. Since only illuminates can do this, Agrippa discusses ritual preparation for illumination.

Agrippa's skepticism, though it often merely points out uncertainties in individual sciences, contains a theoretical attack on human reason reminiscent of Montaigne: Sense knowledge is unreliable; and the mind, darkened by sin, cannot pass from sensory to higher knowledge without illumination. His view of human nature and society is pessimistic. Moral philosophy, law, and institutions arise from arbitrary actions of animalistic natural man. Only in the order of grace can Agrippa find escape from this anarchy. His thought also contains other hints of later libertine doctrines.

Though forgotten today, Agrippa was widely read for two centuries. His reputation for learning made his rejection of all sciences profoundly disturbing; and he thus became a major source of that great symbol of intellectual despair, Faust. 273 pages. $3.41. Mic 56-821

WILLIAM SHORT, JEFFERSON'S ADOPTED SON, 1758-1849 (VOLUMES I AND II)

(Publication No. 13,851)

George Green Shackelford, Ph.D.
University of Virginia, 1955

William Short (1758-1849) was the Virginia descendant of an indentured servant and a baronet's grandson. At nineteen, he placed himself under the direction of Thomas Jefferson, who called him his adopted son. He studied law under George Wythe after graduation from William and Mary in 1781, where he was a founder of Phi Beta Kappa. After election to Virginia's Executive Council in 1783, he was thought more promising than his contemporaries John Marshall and James Monroe.

Jefferson made Short his private secretary when he became Minister to France, enabling him to become America's first career diplomat. When Jefferson returned to Virginia in 1789, Short remained as Chargé d'Affaires, and followed his patron's policy of reducing obstacles to Franco-American trade. La Fayette and La Rochefoucauld, early leaders of the French Revolution, were his friends.

In 1792 Short became Minister to Holland. He was also between 1790 and 1795 the only sole fiscal agent of American history, with great discretionary powers. He borrowed $8,200,000 to re-finance America's foreign debt and for domestic purposes. America's fiscal solvency was probably as much a result of the loans negotiated by Short as of Hamilton's internal policies.

Short was dismayed at the violent, leftish course of the French Revolution in 1792. La Rochefoucauld was assassinated. La Fayette fled, only to be captured by the Austrians, but Short was unable to persuade them to release him on the ground that he was an American citizen.

Short had previously fallen in love with "Rosalie," the Duchesse de la Rochefoucauld. When he was ordered to Madrid as Joint Treaty Commissioner with William Carmichael in 1792, he visited Rosalie and unsuccessfully proposed marriage.

He and Carmichael hoped to negotiate a Spanish treaty recognizing the Mississippi and the thirty-second parallel as the United States' boundary and permitting American navigation of the Mississippi River. Spanish procrastination and the Franco-Spanish War delayed possibilities of success until 1795, when Short had become sole commissioner and Minister Resident, too. Poor communication with America was the chief reason why Short was superseded, when on the verge of success, by Thomas Pinckney as Envoy Extraordinary. Though barred from negotiating, Short unselfishly enabled Pinckney to conclude the desired treaty in late 1795. Thereupon, Short resigned from the foreign service.

Between 1796 and 1802, he lived with Rosalie in France. She refused to marry him even after freed of all family responsibilities. In 1802 Short came back to America to supervise his investments, which were placed in government bonds, canal stocks and land in Virginia, Kentucky,

and western New York. He renewed his friendship with Jefferson, who in 1808 gave him a recess appointment as Minister to Russia after Short had already sailed for France to visit Rosalie. The Senate, however, rejected any mission to Russia in March, 1809.

Short returned permanently to America in 1810, at about the time that Rosalie married the Marquis de Castellane. He settled at Philadelphia, where he managed his investments and participated in the social and intellectual life of the city, leaving it for annual summer journeys to the springs or to Monticello.

Short was a member of the American Philosophical Society and gave to it important donations. For several years President of the American Colonization Society, he bequeathed ten thousand dollars to it, although he had determined that gradual emancipation through serfdom would be better than transporting the slaves to Africa. He assisted the University of Virginia to obtain its faculty in its early years. He died a lonely bachelor millionaire, having given most of his estate to two nephews several years before his death in 1849. 584 pages. $7.30. Mic 56-822

JOURNALISM

AN ANALYSIS OF ADVERTISING AND PROMOTION BY STATE GOVERNMENTS

(Publication No. 15,221)

Donald Goodman Hileman, Ph.D.
University of Illinois, 1955

In the past two decades many states have passed legislation authorizing programs for the purpose of advertising their recreational and industrial facilities and agricultural products. This thesis records the historical development of such programs in an attempt to present empirical data with which to make an evaluation of advertising as a function of the state and to determine how effective states have been in fulfilling this function.

The writer used three methods of research in compiling his data — historical analysis, case study and statistical analysis. The historical method was employed in collecting the information presented in the first four chapters. Chapters I and II view community and cooperative advertising as preceding advertising by the states. These chapters attempt to show similarities and differences, as well as the general relationship, of state advertising to community and cooperative advertising. Chapters III and IV trace the development of state advertising to attract tourists and industry and to promote agricultural products.

A case study was made of the four advertising programs in the state of Washington — the tourist program and the three agricultural product commissions for apples, soft fruits and dairy products respectively. This was done in hope that a more detailed analysis of a single state's activities would add to the knowledge gained in the understanding of the general development of state advertising.

The statistical method was utilized in presenting the information in Chapters IX through XIII on the administration and execution of state advertising programs. The two concluding chapters include the writer's evaluation of advertising as a state function and his recommendations for more effective execution of such programs in the future.

The primary difference between state advertising programs and the voluntary community and cooperative advertising programs is in the source of funds. The governmental factor in state advertising causes some difference in administration of the two types of programs. The state programs are usually larger in size and scope than the voluntary programs, although this is not necessarily always the case. Otherwise, there is little difference in the execution of the two types of programs. In most states the state tourist and industrial programs have served to supplement rather than replace the voluntary programs. This is not as true for the state agricultural product advertising programs.

The writer establishes a standard to determine if advertising is a proper function of the state government and concludes from this standard as applied, that potentially state advertising can make a contribution toward increasing human satisfactions. Whether it does or does not depends a great deal on the wisdom of an individual state in its decision as to what type of advertising to do, as to what extent it will advertise, and as to how it will carry out a specific advertising program. This thesis mentions some of the factors to consider in making a wise decision.

It is impossible to say a specific state department is best for the administration of the advertising program. State programs established as independent agencies and governed by commissions, however, seem to have the best opportunity for success. It is suggested commissioners be elected by the groups or individuals who contribute financially or benefit directly from the advertising.

Research indicated that in the execution of the state programs there is a need for valid research and the development of host schools in tourist promotion. State programs to attract industry should be centered around information, education and service. An effective two-way communication system between the advertising organization and the industry and local chambers of commerce in the state is important and necessary.

The degree to which the production-marketing-promotion process can be coordinated determines the relative success of a state agricultural product advertising program. States should explore the possibilities and advantages of interstate promotional programs. States promoting their dairy industry need to re-evaluate the promotional programs for dairy products in view of the more basic problems facing the industry. 356 pages. $4.45. Mic 56-823

LANGUAGE AND LITERATURE, GENERAL

THE TREATMENT OF THE NEGRO WOMAN AS A MAJOR CHARACTER IN AMERICAN NOVELS 1900-1950

(Publication No. 15,566)

Beulah Vivian Johnson, Ph.D.
New York University, 1955

This study attempts to show what characteristics were attributed to Negro women who appeared as major characters in American novels during the first half of the twentieth century, and to reveal significant changes in the treatment of these characters during the five decades involved. Inquiry is made also into similarities between the fictional Negro woman and the Negro woman in life in the areas of education, occupations and political activities, and in such other areas as the data seem to warrant.

The data for this study were secured through the analysis of the presentation of two hundred and nine major Negro women characters who appear in the ninety novels which were found to be appropriate to this study, i.e., novels which were published between 1900 and 1950 and with plots based upon events which occurred primarily within the United States of America, whose content was sufficiently realistic to be applicable to, or reflections of, real life, and one of whose major characters was identifiable as an American Negro woman.

Fifteen categories with carefully defined indicators were utilized in making the analysis. These categories were designed to include the subject of the plot in which the character appeared, as well as the character's personal appearance, attitudes and general behavior and station in life. Other factors which might affect the interpretation of the data were also taken into consideration in the statement of findings and implications.

During the first two decades (1900-1920) white novelists attempted to romanticize the methods by which white supremacy was restored in the South after the Civil War, to popularize the happy plantation legend and to emphasize the irresponsibility and helplessness of the Negro race. Negro women characters appeared in these novels as comedians, good old mammies, debasers of white men's morals and harbingers of dissatisfaction with freedom from slavery.

Negro novelists of the same period attempted to deny the picture painted by the white authors, and they presented the Negro woman as physically attractive, altruistic, intelligent, chaste and decorous. Neither of these two groups of fictional Negro women bore close resemblance to the Negro woman in life, although each type no doubt had some basis in fact.

With the Negro Renascence following World War I, both Negro and white novelists began to attempt more realistic interpretations of Negro life, and by the close of the half century the Negro woman appeared more fully developed as a character and more carefully individualized than in earlier novels.

In the areas of education and occupations the fictional Negro woman paralleled roughly the Negro woman in life, with the exception that in neither area was the more highly trained Negro woman portrayed in the novels. In the novels Negro women became progressively less concerned with politics and social welfare activities, while in life the opposite was true.

The findings in this study demonstrate that fiction is often both a part of, and apart from, life. The treatment of the Negro women characters reflects in varying degrees the interests of novelists in general in the less successful American, in the social conditions and the economic psychological problems which existed in America, and in sexual experiences. However, emphasis upon the less fortunate Negro woman and the woman with social behavior characterized by immorality to the exclusion of the more successful, the more gifted and the more socially responsible woman created a distorted image of the Negro woman.

This study concludes, therefore, that one must look elsewhere than to American novels of the first half of the twentieth century if he wishes to have a complete picture of the Negro woman in life.

556 pages. $6.95. Mic 56-824

ROBERT PARSON'S THE FIRST BOOKE OF THE CHRISTIAN EXERCISE (1582): AN EDITION AND A STUDY

(Publication No. 15,637)

Robert McNulty, Ph.D.
Columbia University, 1955

The First Booke of the Christian Exercise, known as the Resolution, by the Jesuit Robert Parsons was one of the most popular guides to godliness of the late sixteenth century; it retained its popularity through the seventeenth and eighteenth centuries, and it was republished as late as 1865. First printed in 1582, it was reprinted in a Protestant version by Edmund Bunny in 1584. Parsons replied to Bunny in an expanded version of the work, now called The Christian Directory, in 1585, and Bunny replied to him in 1589 in a separate work, A Brief Answer. Parsons once more slightly revised his book in 1607, but he never completed the second and third parts which he had promised.

Parsons hoped to provide in the book not only a strong exhortation to the godly life but also an instrument which might be used effectively in bringing Protestants back to the Roman Church. He was therefore consistently mild in tone and he deliberately avoided controversial subjects. Bunny recognized the mild tone and deliberately retained

it, changing only those points in the book which were specifically Roman Catholic. He removed all references to chance and fortune, free will, satisfaction, salvation by good works, merit, and penance. He added "A Treatise Tending to Pacification" in which he discussed directly the differences between Roman Catholics and English Protestants, pointed out how few and small those differences were, and urged the Roman Catholic to become Protestant as a start toward a way of life nearer to the will and word of God than was the Roman Catholic way. He thus inverted one of Parsons's major intentions in writing the book.

The book was popular with both Roman Catholics and Protestants and was credited with many conversions to the godly life. Robert Greene in his Repentance told in detail of the effect of the book upon him, and Richard Baxter later cited it as decisive in his own conversion. Many writers of the period, including Nashe and Harington, referred to it. In 1700 a new Protestant version of the book was published by Dean Stanhope of Canterbury.

The present edition reprints the first edition of 1582 and indicates in footnotes the changes made by Bunny in 1584 and Parsons's replies in 1585.

744 pages. $9.30. Mic 56-825

AN EDITION OF SOME OF THE CANTIGAS D'ESCARNHO E DE MALDIZER

(Publication No. 15,878)

Florence Virginia Phillips, Ph.D.
The Ohio State University, 1955

The need for an edition of the cantigas d'escarnho e de maldizer has been expressed by Rodrigues Lapa in Licoes da litteratura portuguesa, Epoca Medieval (1951), 184.

The forty-five cantigas – CV 904-910 (CB 1300-1305) by Estevam da Guarda, CV 945-962, 964 (CB 1338-1354, 1356) by Don Lopo Lias, CV 965-978 (CB 1357-1370) by Martim Soares, CB 1521 by Gil Peres Conde, CB 1545, 1547-1549 by Joan Vaasquiz – represent samplings of the genre and are the trovas, in one instance, of the so-called best troubadour and, in another, of a troubadour who presumably wrote no other type of lyrics.

Microfilm reproductions of the Cancioneiro da Vaticana, Codex 4803, from the Vatican Library in Rome, Italy, and the Cancioneiro da Biblioteca Nacional, from the National Library in Lisbon, Portugal, were obtained as the basis for the texts.

The cantigas d'escarnho, in which the troubadour covertly satirizes by using equivocal words, and the cantigas de maldizer, in which the satire is explicit and open, comprise lyrics with numerous narrative themes. Some are very personal and topical such as those directed to the traitorous chief huntsman, Alvar Rodriguis, the deformed Moor, Johan Fernandez, and the soldadeira Maria Balteira; others are no more than sirventés joglarescs which berate the inadequacies of fellow troubadours. Many are parodistic, one of which, CV 966, is directed to the pleasure-loving Affons'Eanes de Cotom who preferred the ben-dizer of the prostitutes. Twelve of the cantigas form a cryptic burla of four brothers from Lemos called the "zebra knights." As political, social, historical, and lexical sources, they are invaluable.

The satirical types, escarnho, maldizer, joguete d' arteiro, risabelha, and other miscellaneous nomenclature: seguir, tençon, maestria, refram, dobre, mozdobre, palavra perduda, have been defined and explained in relationship to their corresponding Provençal terminology by a comparison of the fragmentary treatise entitled Arte de Trobar, source of poetic terminology, and the Leys d'Amors. Illustrations of these terms have been cited, and a detailed analysis of the versification of the cantigas of the edition has been graphically made by means of an index adapted from Istvan Frank's Répertoire de la Poésie des Troubadours (Paris, Champion, 1953). A similar index has been added as Appendix I of the satirical lyrics edited by Carolina Michaëlis de Vasconcellos, Henry Lang, and Oskar Nobling.

Texts of the poems are given with critical apparatus, versification analyses, and translations. These are as literal as possible so far as is consistent with good English. We have offered several original verse translations.

The Notes, indexed alphabetically as a part of a complete Glossary following the texts, include observations on linguistic peculiarities, and syntactical, geographical, and historical concepts.

Appendix II contains the Cantigas CB 1505, 1507, 1508, 1510, 1527, 1528, 1553, which are given with variants and versification but without grammatical comment, vocabulary, and translations. 368 pages. $4.60. Mic 56-826

LANGUAGE AND LITERATURE, CLASSICAL

THE CONVERSION OF HERAKLES: AN ESSAY IN EURIPIDEAN TRAGIC STRUCTURE

(Publication No. 13,661)

William Ayres Arrowsmith, Ph.D.
Princeton University, 1954

This essay is an attempt to clarify the structure and meaning of a single Euripidean play, the Herakles, and on that basis to suggest a more general theory of Euripidean structure and unity. It does not attempt a comprehensive line-by-line commentary, nor is it, except incidentally, a study of metaphor or symbolism or dramatic technique. The subject is structure in its broadest sense, taken at the point where the plot becomes, in Aristotle's phrase, the "soul of the play".

The Herakles, because of its structural violence and its apparent division into two autonomous actions, is taken as a test for a theory of unity and coherent structure. The theory proposed, after analysis of the play, is that of "conversion". In terms of plot, "conversion" is intended to cover the systematic transfiguration of one action in the action which follows it. The commonest form of such conversion in Euripides (and one which the Herakles is claimed to exhibit) is that in which a story based upon received beliefs – the corpus of myth and legend, the world of "things as they are said to be" (hōs lelektai) – is systematically, in its terms, its characters, the values it enshrines and invokes, "converted", under dramatic

pressure, to another level of reality, to a world of "things as they are", the full reality of created, rather than received, tragedy. We get, that is, something like a dramatic mutation of received reality, and the leap the play makes between the levels of its two realities, corresponds, in force and vividness and apparent unpredictability, to mutations in the physical world. In order for this conversion of received reality to take place, it is not necessary that there be a complete and traditional story (logos) presented, but merely that the treatment and its use of characters and values be traditionalized. Similarly, anachronization is regarded as present in both actions and helps to bridge the structured opposition between the play's two realities. Thus the Herakles begins with a world hōs lelektai, traditional and predictable by virtue of common report taken as true, a world content with the dramatizing of the known. Then, with shocking suddenness, the play abandons the "plateau" of logos and tradition and, in a new action, without causal ground in the old one, discovers a second plateau, a world of reality of a different degree altogether; when the play closes, characters, motives, values and the older terms of logos have all been transformed and pushed to the frontiers of reality and morality alike. The connection between these parts is not Aristotle's desiderated propter hoc, but is no less necessary and no less "organic".

Finally, it is claimed that the theory of conversion, with its insistence upon the presence in the play of two realities — "things as they are said to be" and "things as they are" — regarded not as contradictory but as successive and developmental, obviates the crudities of the "rationalist" interpretation of Euripides on one hand, and the literalist's cry of inconsistency and botching on the other. Moreover, it does so by recognizing the genuine difficulties which those theories were intended to solve, without creating additional difficulties or bypassing old ones, unless the attempt to show non-Aristotelian structure in Euripides is to be regarded as frivolous or wrong-headed from the outset.

307 pages. $3.84. Mic 56-827

LANGUAGE AND LITERATURE, LINGUISTICS

THE METRICAL STRUCTURE OF OB-UGRIC FOLK-POETRY

(Publication No. 15,731)

Robert Paul Austerlitz, Ph.D.
Columbia University, 1955

This is an analysis of Ostyak and Vogul metrical texts, based on the immanent linguistic features of the material rather than on a priori metrical notions.

The material used is the complete available corpus of Ob-Ugric metrical texts. One portion of this — the central corpus — consists of nineteen texts, recorded from sung performances of Ostyak song-texts (Šerkaly dialect), collected and published by W. Steinitz (Ostjakische Volksdichtung und Erzählungen, I: Tartu, 1939; II: Stockholm, 1940). All the remaining texts (recorded from recitation and not from sung performances) constitute the complementary corpus (presented in the Appendix, with English translations). Results are checked against the material in the complementary corpus.

The grammatical notions necessary for metrical analysis are discussed. — Earlier literature is reviewed.

Metrical analysis begins with the segmentation of texts into their component sentences. This operation is carried out syntactically: sentence-boundaries can be established by reference to the finite verbal forms which necessarily appear at the end of each sentence. These verbal forms and a limited number of well-defined words (subject, object, etc.), which regularly precede them and with which they form patterned main phrases of sentences, are called verbal lines. The phrases which precede the verbal lines often consist of smaller phrases which exhibit mutual similarity. When two such phrases are identically constructed with the exception of one word (or sometimes two words) appearing in the same relative position in each of them, we speak of parallel structures. Parallel structures can be further analyzed into parallel lines. Terrace lines are characterized by the fact that the concluding portion of one line reappears at the beginning of the following line. Parallel lines and terrace lines form the class of cohesive lines. Opposed to this is the class of isolated lines which are distinguished by the fact that they never cohere with any other line. These are either anacrustic (lines which usually appear in introductory or exclamatory functions) or orphan lines (which form a remainder group). Of the 2568 lines of the central corpus, 924 are verbal lines, 1170 are parallel, 29 are terrace lines, 344 are orphan lines, and 74 are anacrustic. (Twenty-seven lines are characterized by echoing, i.e., the repetition of their latter portion.) Verbal lines and parallel lines constitute the overwhelming majority of lines in the central corpus. — Segmentation thus yields the basic metrical units and reveals the main characteristics of the running text.

The most important device restricted to the interior of a line (the etymological figure) is the recurrence of the same root with varying suffixes.

Quantitative analysis, based on a syllable count of all the lines in the central corpus reveals primarily that a definite numerical structure prevails throughout each text and that verbal lines, as a class, are never longer than non-verbal lines. This is illustrated by graphs.

The complementary corpus exhibits much less regularity in the length, construction, and mutual cohesiveness of its lines: all texts in it were recited (dictated) and not sung. Expletives (words and syllables which appear in lengthening and filling-out functions in verse and are absent from prose) abound in the central corpus and are scarce in the complementary corpus.

Repetition as a metrical device is discussed separately.

A brief discussion of the melodies of fifteen of the nineteen texts and some remarks concerning the genetic and areal affinities of the type of metrical structure discussed conclude the essay. 440 pages. $5.50. Mic 56-828

A STUDY OF THE VERB GET

(Publication No. 15,735)

Thomas Lee Crowell, Jr., Ph.D.
Columbia University, 1955

The dissertation is an exploratory study of how the verb get functions in present-day standard American colloquial English and of how it came to do so. The dialog of ten modern American plays, containing 1588 instances of the verb, is used as an indication of current speech. Theories stated by various writers are tested against that source material.

The verb is examined from eight standpoints: status, diversity of meanings, currency, paradigm, relation to anomalous finites, complements, similarity to other verbs, and history.

It is found that, although some grammarians have held the verb get in low esteem, it has a high frequency of use both in conversation and in writing. The multiple definitions of the verb are grouped according to four "core meanings": 'obtain,' 'effect (the change to the position or state expressed by the modifying complement),' 'possess,' and 'must.' The paradigmatic forms of the verb vary according to the core meaning. With the meanings 'obtain' or 'effect,' get has a "full paradigm," that is, it occurs in all customary tense forms and periphrastic combinations. With the meanings 'possess' or 'must,' the paradigm is "defective": the verb occurs only as a present finite, although in British usage it occurs as a past finite with both meanings and as an infinitive with the 'possess' meaning. The forms meaning 'possess' can be viewed as part of a composite paradigm with the verb have, and those meaning 'must' as part of another composite paradigm with have to. The past-participle form gotten is specialized: it occurs only with the meanings 'obtain' or 'effect'; while the form got is unspecialized, occurring with all four meanings. Also, the locution "I got" meaning 'I possess' and the locution "I got to" meaning 'I must' indicate that the verb is developing a preterit-present.

The syntactical constructions in which the verb occurs also differ according to the core meaning. With the meanings 'obtain' or 'possess,' the verb has a dirct object as a complement, whereas with the meaning 'effect' there may or may not be a direct object, but there is always a modifying complement. With the meaning 'must,' the verb is always followed by to and has an infinitive as its complement.

With get meaning 'obtain' and 'effect,' the "anomalous finite" do is used in present-tense expressions with question word-order (e.g., "What do I get for my money?"), with negation by -n't (e.g., "I don't get quick action"), and in "disjunctive clauses" (e.g., "You get quite a lot." "I certainly do"). The anomalous finite used with the verb meaning 'possess' in similar expressions is have (e.g., "Have I got time?"; "I haven't got time now"; and "I got time, haven't I?"). In the plays, the verb seldom occurs with the meaning 'must' in such expressions, but when it does, usage is divided between do and have as the anomalous finite (e.g., "We've got to pay them, don't we?" and "I've got to catch a boat." "So have I").

The meaning 'obtain' appears in writing around 1200. The meaning 'effect' seems to have arisen soon afterwards, evidently from the decline of use of reflexive pronouns as objects (e.g., "I get myself up"). The 'possess' meaning apparently developed in the sixteenth century: have got was substituted for have to strengthen the subject + verb construction in the place where, through reduction of stress on have, that construction was not clearly indicated (e.g., "I've a dollar"). A similar reduction of have in "I have to go" may have led to the 'must' use of "I have got to."

194 pages. $2.43. Mic 56-829

AN ETYMOLOGICAL GLOSSARY OF THE EAST YORKSHIRE DIALECT (VOLUMES I AND II)

(Publication No. 15,480)

Albert Lyon Hoy, Ph.D.
Michigan State University, 1952

The compilation of an etymological glossary of the East Yorkshire dialect is important, because of the need of preserving in written form the vocabulary of one of the most interesting types of Northumbrian folk speech. Due to the social reverberations of two world wars, the dialect has been seriously affected, and now is being gradually discarded in Yorkshire. Since it is likely to disappear in a few decades, a descriptive treatment of it is timely.

Previous treatments of the East Yorkshire dialect consist mainly of word lists with scanty references to cognates in other languages. The only glossaries extant do not clearly identify the significant differences of the Northern, Eastern, and Western dialects of Yorkshire. The glossarists were well-intentioned men who had no fluency themselves in the folk speech of East Yorkshire. Their diversified spellings, pronunciations, and meanings make this further study of the dialect feasible.

The work of compilation and etymological classification in this glossary has been done by a former resident of East Yorkshire, who has spoken the dialect regularly for more than twenty years. Before entering the United States in 1926, he lived in the villages of Yorkshire, and identified himself completely with the speakers of the dialect. In connection with linguistic studies on the dialect, he made a visit to England in 1951, and spent several weeks there recording the speech forms of the Yorkshire people.

In the preparation of the etymological glossary, the method of procedure was first to examine the extant Yorkshire glossaries, and collect from them all the words which could be identified as belonging to East Yorkshire folk speech. These results were then checked for reliability during the time which the compiler spent among the Yorkshire people in 1951. The historic influences upon the dialect were then considered, and a number of foreign language dictionaries were freely used to determine the etymons of dialectal words. In this aspect of the work, the more extensively used lexicons were Bosworth's Anglo-Saxon Dictionary, Cleasby's Icelandic-English Dictionary, Holthausen's Altenglisches Etymologisches Wörterbuch, Molbech's Dansk Ordbog, Skeat's Etymological Dictionary, and Torp's Nynorsk Etymologisk Ordbok.

As the etymons of the dialectal words were identified, investigation was made in twenty-seven Middle English writings (mostly northern) to obtain illustrations of the forms from which dialectal words were derived. Many

such illustrations appear in the glossary. Under each entry an illustration of the use of the word in East Yorkshire folk speech is given.

The particular value in this work lies in the light which it throws upon the significant correspondences between the dialect and its Old English, Scandinavian, and Celtic sources. Assistance may be obtained from it in determining some of the historical influences of invasion and conquest in the north of England. It may also be helpful in identifying the vicinities from which some northern Middle English writings originated, and its surviving forms of Old English and Old Norse should be of some value in the study of the English language. 559 pages. $6.99. Mic 56-830

THE FRANCO-CANADIAN DIALECT OF WINDSOR, ONTARIO: A PRELIMINARY STUDY

(Publication No. 15,705)

Alexander Hull, Jr., Ph.D.
University of Washington, 1955

The Franco-Canadian dialect of Windsor, Ontario, is spoken by an isolated group of French Canadians living in the counties of Essex and Kent in southwestern Ontario. They are descendants of the original founders of Detroit, who colonized the region during the early eighteenth century, and of later immigrants from Quebec. Nearly a century of isolation caused the development of certain local speech peculiarities, many of which have been leveled since by increasing contact with Quebec. The impact of English has been strong, especially in recent years, when the whole group has become bilingual, with few exceptions. They are now a minority in the region, and their language is used almost entirely in the home, with resulting impoverishment of the vocabulary. Many children refuse to speak French. Cultural contact with Quebec has been rendered difficult. Attempts are being made to remedy the situation through the schools and social groups, with sporadic success.

The material for this dissertation was gathered by the investigator through personal field work in Windsor. A questionnaire was administered to four principal informants — a poorly educated factory worker, completely bilingual; a retired carpenter, who had spoken only French as a child; a more highly educated man; and a middle-aged woman. Tape recordings were made of the speech of the first informant, his wife and children, and that of the old carpenter.

The phonology of the dialect differs considerably from that of the standard language, but only in minor points from that of Canadian French in general. Important traits are: the maintenance and strengthening of length distinctions in the vowels by opening and relaxing of the short high vowels and diphthongization of other long vowels; the shift of final standard /-è/ to /-a/ and final /-a/ to a low back rounded vowel /-å/; the tendency to assimilate consonants to the following vowel, giving rise to palatalized and affricated consonants (which, however, are not as prominent as in Montreal); the simplification of consonant clusters; and the preservation or loss of final consonants in a different pattern from that of present-day standard French.

The morphology and syntax of the Windsor dialect also show many differences from the standard language, but few from that of Quebec. Gender shifts, especially in words beginning with vowels, are numerous. Adjectives show irregular feminines, or remain invariable. Third-person subject pronouns tend to be reduced to a single form /i/; nous as subject is replaced by on. Many irregularities occur in the conjugation of verbs. The most striking of these is perhaps the reduction of the imperfect and conditional to the single ending /-a/. Periphrastic forms (such as être après with the infinitive for the "progressive") tend to be used instead of the normal tenses, probably through the influence of English. English influence is also strong in the use of prepositions.

The vocabulary of the dialect can be divided into: old words, primarily of seventeenth-century French origin (both standard and dialectal, some now obsolete in France), but including some Canadianisms; "learned" words brought in from contemporary French through school influence (most noticeable in the speech of the educated); and borrowings from English. These last are of greatest interest and are of two types: early loans showing phonetic adaptation and recent loans pronounced as in English. They occur in almost every field of thought and are not restricted to nouns. English influence penetrates the dialect in other ways, giving rise to adaptations of French words, loan-shifts involving the extension of the semantic sphere of a French word, and loan-translations.

451 pages. $5.64. Mic 56-831

AN ANALYSIS OF MODERN FRENCH VOCALIC PATTERNS, 1884-1953: A FUNCTIONAL-STRUCTURAL SURVEY

(Publication No. 15,640)

Gene Montague Sackrin, Ph.D.
Columbia University, 1955

This study attempts to construct phonemic patterns for French vowels as described in works published from 1884 to 1953 and to survey phonemic systems during that period. The focus of attention is centered on the following phonemic oppositions and features: 1) pli-plie /pli-pli:/; 2) mot-mots /mò-mo/; 3) tousse-tous/tus-tu:s/, couvent-couvant /kuvã-ku:vã/; 4) fée-fait /fe-fè/; 5) mettre-maître /metr-me:tr/; 6) patte-pâte /pat-pɑt/; 7) jeune-jeûne /žoen-žøn/; 8) pomme-paume /pòm-pom/; 9) unstable e; 10) brin-brun /brɛ̃-brõe/, trempé-trompé /trãpe-trõpe/; 11) pays-paye /pei-pey/; 12) consonantal assimilation. In the concluding chapter, an explanation is offered as to the differences in the descriptions and a discussion is included concerning language drift occurring in the French vowel system during the above era.

One of the important scientific advances of the 20th century occurred in the field of language description with the discovery of the functional-structural approach. No longer are purely phonetic descriptions of language considered adequate but such descriptions must be accompanied by phonemic analyses which afford clearer insights into the functioning of the sound system.

André Martinet, a pioneer in the phonemic analysis of French, utilized some of the theories of Ferdinand de

Saussure as developed by the so-called Prague School and presented by N. S. Trubetzkoy. De Saussure established a dichotomy between langue (the abstract pattern of the sound structure) and parole (the overt realization of this structure).[1] Trubetzkoy and others stated that the sound system of language consisted of oppositions of phonemes which were suspended or neutralized in well-defined positions.[2] The structure of language was established in terms of phonemes, the abstract tools of phonology, and archiphonemes. In some respects, the theories of Edward Sapir and Leonard Bloomfield were similar insofar as they utilized phonemes and described sound patterns in language.

The period under study may be arbitrarily but conveniently divided into four periods: 1884-1899, 1900-1927, 1928-1939, 1940-1953. During the first period, such phoneticians as Passy and Rousselot were describing the raw sounds of French. From 1900 to 1927, such writers as Grammont, Ph. Martinon, Bruneau and others added their contributions. Martinon based his work on orthoepic considerations. Grammont and Bruneau utilized a phonetic approach. The period 1928-1939 which saw the emergence of the functional-structural approach witnessed the descriptions of J. Damourette and Edouard Pichon, pioneers in the phonemic approach (1928), Georges Gougenheim, author of Eléments de phonologie française (1935), and André Martinet who from 1933 on analyzed the phonemic system in a series of articles and books.

The modern systems for cultured Parisian appear to be the following:[3]

Absolute final position			Checked tonic position		
i	ü	u	i	ü	u
e	ø	o	e/ɛ:	ø/œ	o/ɔ
	a/ɑ			a/ɑ	

243 pages. $3.04. Mic 56-832

1. F. de Saussure, Cours de linguistique générale.
2. N. S. Trubetzkoy, Principes de phonologie, translated into French by Cantineau.
3. Cf. A. Martinet, La Prononciation du français contemporain, 206. A vertical line indicates an opposition based on length, a diagonal line indicates an opposition based on length and timbre.

LANGUAGE AND LITERATURE, MODERN

DON JUAN IN THE GENERATION OF '98

(Publication No. 15,804)

Stephen Hamilton Ackerman, Ph.D.
The Ohio State University, 1955

The perennial literary and popular interest in Don Juan Tenorio has raised this figure to the realm of legend and myth. In this nebulous sphere, he becomes incapable of exact definition and presents a fruitful source for literary, sociological, and psychological interpretations. Unable to crystallize the character of Don Juan in a universally acceptable form, the person who treats this theme must necessarily reveal some aspects of his own thought rather than absolute data on the subject of his investigation.

In the dissertation we have examined the treatment of Don Juan by several authors commonly associated with the so-called "Generation of '98." Unamuno, Azorín, and the Machados turn the protagonist within himself, making him tragically aware of the evils of his past life. This consciousness of the self leads in turn to a re-evaluation of the meaning and purpose of existence. Each author works out the problem in his own way: Unamuno's Don Juan in a frustrated attempt to understand himself and his role in life, the protagonists of Azorín and the Machados giving themselves over to lives of charity and self-sacrifice.

Valle-Inclán presents a complex re-creation of Don Juan torn between good and evil. Blending the demoniac tendencies of the late Romantics and a false version of the caballero tradition with the instinctive drives of the libertine, the author brings his protagonist to the misery and disillusion of old age.

Baroja, although not possessing a single work dedicated to the Don Juan theme, frequently indicates his antipathy for the burlador as he was portrayed by Tirso and Zorrilla.

Maeztu, in an apparently objective study of Don Juan, chooses to salvage the force and energy which he sees embodied in the libertine. For this author, the synthesis of all the elements of strength in the burlador form the ideal of power to which Spain must look in her period of weakness.

All of the works examined in this study indicate the tendency to look back into Spanish history and tradition in an effort to rediscover the values of the Spanish heritage while rejecting the false and weak elements. This inclination is considered one of the basic attributes of the "Generation of '98." It is, however, a tenuous connection at best. Only in the results of these investigations into the past may we perceive true generational relationships. In our study we have seen all but one of these authors completely reject the traditional concept of Don Juan, depriving him of the attributes which Tirso and Zorrilla had emphasized. Only Maeztu, in his acceptance of the presumed strength of Don Juan, stands apart from the other authors whom we have studied.

191 pages. $2.39. Mic 56-833

A CRITICAL EDITION, WITH INTRODUCTION AND NOTES, OF VÉLEZ DE GUEVARA'S EL CONDE DON SANCHO NIÑO

(Publication No. 15,811)

Robert Jeffers Bininger, Ph.D.
The Ohio State University, 1955

The extant dramatic works of the Spanish dramatist Luis Vélez de Guevara (1579-1644) include some sixty-nine three-act plays of which he is the sole and reasonably authenticated author. A few of these plays, such as the tragedy Reinar después de morir, are of exceptional merit and have helped secure for their creator a high and enduring position in the Spanish literary hierarchy. The majority, however, have little intrinsic value and have been permitted to remain in the relative obscurity of rare

and archaic texts. Yet these mediocre plays, if made accessible and readable in modern editions, contain evidence concerning Vélez which merits the attention of the student of Spanish literature. The great works did not, after all, spring full-blown into existence; they are the product of experience gathered in the active practice of the writer's art. This is especially true of the Spanish comedia which, like the modern cinema and television, was written and produced in response to the almost insatiable demands of a mass audience. It was not an art based like the French classical theater upon reasoned theory and guided by explicit precepts. Consequently, the real record of its formation and development, along with those of its practitioners, is not to be found in formal arts poétiques and revisional marginalia so much as in the matrix of lesser plays in which the chefs d'oeuvre were formed. It is for that reason critical editions of the minor works, such as this one of El Conde don Sancho Niño, are not only justified but essential to the fullest possible knowledge of Vélez de Guevara and of the Golden Age drama in general.

With this broad purpose in mind, the immediate objective of the present edition has been to establish the text of the play as definitively as possible and to implement it with the essential critical and editorial apparatus. To that end an introduction and two sets of notes have been provided. The Introduction deals with such matters as date (established at 1614-18), authenticity, ballad sources, description of the text and historical element, and includes a critical analysis of the play and a combined plot summary and analysis of versification. The footnotes are limited to textual data. Information of a lexicographical, explanatory, and critical nature is included in an integral body of notes following the text. The text itself is based upon a photostatic copy of a single suelta printing preserved in the Palatinate Library in Parma, a copy of which also exists in the Bibliothèque Nationale in Paris.

252 pages. $3.15. Mic 56-834

LA LITERATURA POLITICA DE GONZALEZ PRADA, MARIATEGUI Y HAYA DE LA TORRE

(Publication No. 15,692)

Eugenio Chang-Rodríguez, Ph.D.
University of Washington, 1955

In this work the author has made a comprehensive study of three writers who have exerted great influence upon the literary production and political thinking of modern Peru. Previously very few attempts have been made to study the history of liberal ideas in republican Peru. In this dissertation the writer endeavored to trace the development of some of these ideas as expressed in the writings of Manuel González Prada, José Carlos Mariátegui and Víctor Raúl Haya de la Torre. Efforts were made to establish the relationships of their ideas concerning the anticlerical and political problems and each author's stand on the Indianist literary movement of Peru.

The dissertation is divided into four parts. The first one, entitled "The Unfinished Revolution," gives the historical, political and literary background of Peru prior to Manuel González Prada. It begins with the ideology and struggles of the fathers of Peruvian independence, who failed to carry out the complete emancipation of the country. They had succeeded in proclaiming the political separation from Spain, but left the old economic and social order almost untouched. Feudalism, which was brought to Peru by the Spaniards, survived in the newborn republic. The masses had only changed masters, and their condition became worse when the military cliques, formed during the wars for independence, claimed to be theirs to power and plunged the country into bloody internal strife. The officers had conceived the idea that the presidency was the highest military rank, and was not to be awarded, but taken. In the midst of this chaos that lasted for over fifty years, a few writers appeared on the political scene preaching the liberal ideas prevailing in Europe. None of them was able to prevent the country from falling into the catastrophic war which Peru lost to Chile, because of her mental and physical unpreparedness.

From the disaster emerged a generation of discontented Peruvians, who were personified by a great thinker and superb writer: Manuel González Prada (1848-1918). To him is devoted the second part of this dissertation, in which a critical analysis was made of his most important contributions to the social organization of the country, and, above all, to the intellectual training of younger Peruvians. The author studied González Prada's ideas on religion to present his anticlerical stand, his political ideas as expressed in all his works, including the posthumous books, and his contributions to the literary Indianist movement as conveyed through essays and poems. This part closes with an evaluation of González Prada's literary and political influence in Peru.

The third part of this dissertation is devoted to the study of the contributions of José Carlos Mariátegui (1895-1930) in the same religious, political, and literary fields. Likewise, at the end of this part, the author has given his estimation of the political and literary influence of this brilliant Marxian writer.

The fourth and last part covers an analysis of the writings of Víctor Raúl Haya de la Torre (b. 1895) regarding the political, clerical, and Indian problems. Because of the impossibility of separating Haya de la Torre from the Aprista movement he created, three sections have been dedicated to the study of Aprista ideas in which Haya's thought played a decisive role. Moreover, in this part there is an additional section presenting his thesis on Historical-Space time, which many have acknowledged as one of the most original applications of the theory of relativity to history. Haya's thesis was included because it is his own philosophical background and that of his party. This last part also concludes with a personal evaluation of the intellectual influence of Haya in the light of his extensive writings and inspiring example.

Each part begins with a biographical summary in order to aid in the understanding of the ideas and accomplishments of each writer, since the author of this work considers a man and his ideas as an indivisible whole.

The bibliography, consisting of works of González Prada, Mariátegui, and Haya de la Torre, and the studies so far made on them, is probably the most complete up to the present time. It has been compiled over a period of five years with the cooperation of several writers from Europe, North and South America. 564 pages. $7.05. Mic 56-835

THE IGNATIAN SPIRIT IN GERARD MANLEY HOPKINS

(Publication No. 15,694)

David Anthony Downes, Ph.D.
University of Washington, 1955

Critics and biographers of Gerard Manley Hopkins have often noted that Hopkins' poetic career falls into two segments: the brilliant and talented youth at Oxford and the ascetic Jesuit priest-poet. They have often said that the greatest influence on the mature poetry of the Jesuit period certainly might be that instrument of spirituality that St. Ignatius Loyola wrote for the men of the Society of Jesus, The Spiritual Exercises. But no study has attempted a careful and complete analysis of Hopkins' poetry, early and late, from the vantage point of the Ignatian spirit of the Spiritual Exercises. This thesis undertakes to analyze the Ignatian spirit in the Hopkins canon.

The first four chapters are given over to a study of the Spiritual Exercises. In these chapters, the nature of the spirit of the Exercises is uncovered through the aid of standard commentaries of the Exercises and with the help of some of the members of the Society of Jesus. More important, in order to discern the effects and influences of the Spiritual Exercises on Hopkins personally, a copy of an extant manuscript of notes of a projected commentary which Hopkins himself planned to write was procured from its depository at Campion Hall, Oxford. The last four chapters are given over to an examination of Hopkins' poetry in light of what was found as the spirit and letter of the Spiritual Exercises. Nearly all the mature poetry is examined in this context as well as much of the early pieces and fragments. Hopkins' voluminous correspondence and the extant notebooks and papers (those which have been published) were used where – and whenever – they illuminated the critique.

The following conclusions were made. The greatest influence on the religious poetry of Gerard Manley Hopkins was the Spiritual Exercises of St. Ignatius Loyola. Analysis confirmed that no other influence has helped more to explicate the difficult poetry of Hopkins, especially in its Christian aspects, than does the Spiritual Exercises. Further, no poet and no other Jesuit poet has so completely and successfully expressed in poetic form the ideals of the Society of Jesus, nor with such poetic quality as that which distinguishes the exquisite Hopkins canon.

227 pages. $2.84. Mic 56-836

WALLACE STEVENS: THE REALITY OF POETRY

(Publication No. 15,739)

Bernard Heringman, Ph.D.
Columbia University, 1955

For Wallace Stevens, life is a continuous dialectic between reality and imagination, including the attempt to arrive at a synthesis. Thus, life is poetry as, for Stevens, poetry is life. His work incorporates this dialectic as both substance and pattern. Its major terms, then, are reality, imagination and poetry, and his vision can be crudely represented with them in a series of formulae (using capitals for the transcendent version of each): REALITY equals reality (nature, the physical, the actual) plus imagination. This is the synthesis. Poetry (in general, or his own) concerns itself with imagination (poetry, art, the ideal) or with reality, or with the varying relations between them. Poetry represents imagination at work on reality, or resisting its pressure (war, appetite, chaos), or attempting reconciliation. IMAGINATION, as art or as metaphysics, transforms reality, transforms life, makes them bearable and fruitful, gives them meaningful form or finds the form which they have. To complete the circle, POETRY, as the synthesis of imagination and reality, equals REALITY.

The structure of this vision appears in most of Stevens' poetry, especially until 1942, as a dichotomy, a division into two realms which clearly pervades the work after 1922. Reality and imagination are explored, particularized, brought to life as two complete worlds, each with its own geography, weather, colors, categories of experience, characters and symbols. They are separately focused on in alternating emphasis from book to book, but dealt with chiefly in their relationships, ranging from full-scale conflict through degrees and kinds of interdependence, balance and harmony to fusion in a culminating synthesis.

Stevens explores and expresses these relationships by means of a number of subsidiary themes and in terms of certain recurrent figures and clusters of figures. The relations of man with his environment, of art with rationalism, of heaven and earth, order and disorder, peace and war: each of these and other themes reflects in its appearances the state of Stevens' dichotomy, the relation and relative status of reality and imagination. The recurrent figures, especially the figure of the poet as a character in the poems, offer the same kind of reflection of the general pattern.

In his use of the poet and of most of the themes just mentioned, and particularly in his concern with the role and value of imagination, Stevens takes a place in the Romantic tradition as it includes Blake, Wordsworth, Coleridge, Baudelaire, Mallarmé, Valéry and Yeats, each preceding him with at least one of his definitions of imagination. On this level he stands out by the thoroughness of his survey and use of the roles of imagination, perhaps by his emphasis on the value of synthesis, and by his affirmation of the possibilities of synthesis in life itself, which is the source and subject and end of his poetry of synthesis, the "supreme fiction."

This central poetry is given its fullest definition in the "Notes toward a Supreme Fiction," and is illustrated and realized in many of the poems which follow that. "Credences of Summer," for example, in some of Stevens' finest poetry gives the full sense of what he has achieved with his dialectic of reality and imagination, the sense of the synthesis which is life. The cyclical process continues, however, so that some of Stevens' last poems deal with the loss of centrality and with various negations of it, the recurrent destructive forces of disorder and circumstance. But imagination survives, in his poems and because of them, as our sufficient resource for the accepting transformation of reality which we cannot live without making or make without living. 247 pages. $3.09. Mic 56-837

THE FATHER-CHILDREN RELATIONSHIP IN THE FRENCH CLASSICAL TRAGEDY (PARTS I AND II)

(Publication No. 15,686)

James Ethel Herring, Ph.D.
Tulane University, 1956

The present study examines a number of French classical tragedies, from Corneille's Le Cid (1637) to Crébillon's Rhadamisthe et Zénobie (1711), in which the dramatist places paternal or filial obligations in conflict with the protagonist's duties toward his family, his country, his God, or some other entity to which he feels morally accountable.

The work is in two parts. Part I, in three chapters, traces the origin of the Roman patria potestas and the development of this concept of parental authority in the French barbaric and modern French civilizations, pointing up the powerful aspects of the family head's jurisdiction. The second chapter analyzes the influence on the patria potestas brought to bear by God-given, or natural, laws as interpreted by such writers as St. Augustine, Cicero and Thomas Aquinas who urged the family chieftain to temper punishment with mercy. The third chapter further treats the patria potestas as reflected in mores and in the writings of the moralists.

Part II examines fathers and children in conflict, as presented in twenty-two classical tragedies, in the light of knowledge derived from the above study of positive laws, natural law and religion and mores of the Roman, French barbaric and modern French peoples. The basic purpose of the study is to evaluate the success or failure of the plays of the classical period predicated on the way in which the playwright resolved the problem posed by father-children relationships and their concomitant tragic developments. To this end the various works are arranged in six categories, each one comprising a chapter, according to the particular type of conflict. In the first category are those plays in which a son's filial obligations are in conflict with his duty to his family. Included in this group are Corneille's Le Cid (1637), Du Ryer's Alcionée (1640), Quinault's Agrippa, roi d'Albe, ou le Faux Tiberinus (1663) and Campistron's Arminius (1684). In the second category are discussed plays in which a father's responsibilities toward his children are in conflict with his duties to his tribe or his country. Corneille's Horace (1641), Rotrou's Venceslas (1648) and Quinault's Stratonice (1660) are illustrative of this group. Plays of the third category are divided into "religious dramas," or pagan and Old Testament themes, in which the inexorable will of the gods — or God — is pitted against man's natural protective instincts, and "Christian dramas" in which filial obligations are in conflict with loyalty to the Christian religion to which the father does not adhere. Representative examples of the "religious dramas" are Du Ryer's Saül (1642), Racine's Iphigénie (1673) and Crébillon's Idoménée (1706). Illustrative of the "Christian dramas" are Corneille's Polyeucte (1643) and Campistron's Adrien (1707). The fourth category is that in which devotion to one's love is in conflict with filial or paternal obligations, as in Racine's Mithridate (1673), in which father and son are in love with the same woman. Also discussed in this category are Campistron's Andronic (1685) and Tiridate (1691). The fifth category is concerned with dissensions and discords precipitated by the intrusion of third parties between father and son. Racine's Phèdre (1677) illustrates this type of conflict for it is here that the scheming stepmother, conscience-stricken because of her illicit love for Hippolytus, allows her husband to believe that she has been wronged by the son. Rotrou's Cosroès (1649) and Corneille's Nicomède (1651) complete this category. The plays of the sixth category set forth the effects of political intrigue upon father-children relationships, but are inferior in dramatic quality to those studied in other categories. Among these are Genest's Pénélope (1684) and Crébillon's Rhadamisthe et Zénobie (1711).

These tragedies, covering a period of seventy-four years, testify to the continued preoccupation of playwrights with the personal dilemmas and moral and ethical problems posed by fathers and children in situations of conflict. This study attempts to focus attention on the changing aspects of the presentation of these problems, and to show that the success of a tragedy was usually in direct proportion to the humaneness with which the problems were resolved.

239 pages. $2.99. Mic 56-838

JEWISH PROBLEMS IN FRENCH LITERATURE AROUND 1900

(Publication No. 15,015)

Micheline Weill Herz, Ph.D.
Cornell University, 1955

Cet ouvrage a pour but d'étudier à une époque cruciale les divers points de vue adoptés à l'égard du juif et du judaisme. Une connaissance intime de l'époque 1900 est indispensable à qui veut comprendre certains aspects des désordres modernes, tel l'antisémitisme: En ce qui concerne notre enquête, l'époque 1900 est à la fois aboutissement et formation. On apporte la dernière touche à la tradition du juif scripturaire, tandis que d'autres tendances s'ébauchent, comme le grief racial ou l'accusation d'orientalisme. L'affaire Dreyfus raidit encore les attitudes et précipitera la re-création d'une littérature juive de langue française, phénomène inconnu depuis le Moyen - Age.

Nous avons divisé notre ouvrage en trois périodes dont nous ne présentons ici que les deux premières: avant et pendant l'affaire Dreyfus. La première partie comprend les théoriciens du problème juif, essayistes à la manière française, mi-philosophes, mi-historiens, chacun s'efforçant de donner du juif une explication totale et définitive. Ces essayistes comprennent Edouard Drumont, Bernard Lazare, James Darmesteter, Anatole Leroy-Beaulieu, et Léon Bloy. Avec l'affaire Dreyfus, la seconde partie de l'ouvrage présente le problème juif monté en épingle par les politiques et devenu l'article de choix d'un programme plus ou moins électoral. Ces politiques comptent parmi eux Charles Maurras, Léon Daudet, Maurice Barrès et Jules Soury. Les critiques littéraires de l'époque, sous l'impact dreyfusien, sortent de leur tour d'ivoire et prennent, eux aussi, parti. Ferdinand Brunetière, Jules Lemaître et Rémy de Gourmont sont en quelque sorte forcés de traiter de la question juive. Le juif abondera plus dans le roman, non seulement dans des oeuvres médiocres, à simple valeur documentaire, mais encore dans les ouvrages de grands écrivains tels qu'Emile Zola, Anatole France,

Paul Bourget, Eugène-Melchior de Voguë. Ces romanciers amorceront un traitement "moderne" de la question juive, et l'on constate une évolution où la caricature traditionnelle du juif s'humanise et tend à se modifier en un personnage de chair et d'os. Obsession du salut, qu'il soit matériel ou spirituel, chez les non-juifs, obsession de la vie chez les juifs, telles sont en définitive les données d'un problème dont la compréhension n'implique pas la solution. La période post-Dreyfusienne verra sous la forme d'une renaissance littéraire juive de langue française le rejaillissement de ce sens de l'existence si jalousement préservé. 477 pages. $5.96. Mic 56-839

CONTROVERSIAL POETRY OF THE CIVIL WAR PERIOD, 1830-1878

(Publication No. 15,796)

Ralph E. Hitt, Ph.D.
Vanderbilt University, 1955

Supervisor: Richmond Croom Beatty

This study attempts to survey the poetry which reflects conflicting sectional interests aroused by slavery, war, and reconstruction in America from 1831 to 1878. On the question of abolishing slavery alone, almost every practicing poet living after 1830 expressed an opinion. The most vehement group of abolitionist poets was found in New England, where each political and sectional conflict between the North and the South provoked a great number of poems denouncing slavery and, subsequently, the South as a whole. Joined by writers of the West and Middle Atlantic States, New England poets pointed to their moral obligation to abolish the South's "peculiar" institution or at least to keep its bounds limited to the South. Utilizing and sometimes manufacturing antislavery propaganda about the South, respected poets like Whittier, Lowell, Longfellow, Bryant, Emerson, and Thoreau sacrificed escapist subjects and scholarly pursuits — sometimes overturned deep-seated principles — to become agitators for correcting the evil of the South.

Walt Whitman and Herman Melville, on the other hand, helped their New York section contribute a more moderate view of slavery and the South. Although neither poet condoned slavery, its extension, or laws asking another section to enforce slavery, both felt that the North had not reached sufficient moral perfection to allow it to interfere in the society of another section. Meanwhile, the proslavery defenders in poetry appeared in comparatively small quantities and late in the controversy. The defenders argued from Scriptural, economic, and social points of view, and oftentimes from the mere expedient of a defensive attitude. The most important poetic defense is Grayson's The Hireling and the Slave, which attempts to correct the picture of the South painted by radical abolitionists while it idealizes the slavery system on the Southern plantation.

The writers of war verse in all sections during the conflict sought to arouse men to fight, to celebrate heroes, and to degrade the enemy while lauding their own forces as right in the eyes of God. The quality of their poetry was usually poor, and tended to trite patriotic slogans, sentimentality, optimistic belligerency, and overt piousness. The major poets of New England ranged themselves in attitude between Whittier's quiet sanction of a necessary war for abolition and Lowell's exultation in punitive measures against a section which had held superior political authority over the North too long. At the end of the war most New England poets felt reunion to be fact and extended benevolence and pardon to the South in their writings. Brownell, Emerson, and Lowell, however, felt that a long period of chastisement and re-education of Southerners would be necessary before the South could ever be allowed first-class citizenship again.

Primarily because of the work of Melville and Whitman, the Middle States poets again displayed a more moderate and objective view of war and reconstruction. Melville and Whitman penetrated the emotional surfaces of war motives and saw at once the epic grandeur and the pathos of men struggling on both sides. Both hoped to effect sympathetic understanding between the opponents after the conflict.

Henry Timrod was the most outstanding Southern war poet. Although many of his poems are typical war journal verses, "The Cotton Boll" — among others — is a unique, restrained patriotic statement. Frank Ticknor, August Requier, Mrs. Margaret Preston, and John Reuben Thompson deserve mention for special contributions to the Southern poetry of conflict. With the defeat of Southern arms and hopes in 1865, the poets divided themselves in attitude toward reconstruction. Father Ryan typifies the attitude of the "unreconstructed" Southern poet, as Thomas Nelson Page exemplifies the romantic escapist into the plantation past, and Hayne and Lanier, in different ways, represent the desire for peaceful assimilation into the Union.
474 pages. $5.93. Mic 56-840

DAS SCHAUSPIEL CARL ZUCKMAYERS: WESEN, GEHALT UND BEZIEHUNG ZU DEM GESAMTWERK; MIT EINER BIBLIOGRAPHIE DES VON UND ÜBER CARL ZUCKMAYER VERÖFFENTLICHTEN SCHRIFTTUMS (1920-1954)

(Publication No. 14,989)

Arnold John Jacobius, Ph.D.
New York University, 1955

Adviser: Ernst Rose

(1) An attempt is made to describe and interpret the plays of Carl Zuckmayer in relation to the poet's personality, artistic development, and thought.

(2) Zuckmayer's mode of thinking and attitude toward life has been strongly influenced by his conception of nature. Nature, according to Zuckmayer, bears her meaning in herself and is justified in all her manifestations on her own rights. Nature's infinite cycle of life and death will eventually result in the triumph of life.

(3) Man is a part of nature, and yet subject to his own "natural order" (Natürlichkeit). Self-realization - "maturity" - is man's sublime destination and as such predetermined. Zuckmayer's work is permeated with the idea of "Humanität". Reverence and respect for the dignity of man is the basis of "Humanität", - perfection of one's own personality its fulfilment. Human qualities and ethical

values, rather than rank of birth and social standing determine man's "nobility".

(4) The dramatic works of Carl Zuckmayer represent man not as an isolated individual, but in relation to his society and his time. In this respect, they may be termed "historical plays". The significance of Zuckmayer's plays dealing with contemporary events and the position the poet takes toward his own time are discussed in detail.

(5) In view of the great wealth of topics and ideas contained in the writings of Carl Zuckmayer, attention is focussed on a core of basic motifs and themes. Thus, the "Heimat" motif is found to recur again and again in Zuckmayer's plays. "Heimat" is neither conceived as a biological entity nor in a nationalistic sense, but is thought of as a spiritual relationship, as a form of "belonging". The opposite of "Heimat" - the idea of "Heimatlosigkeit" - has attained dramatic expression in the many picaresque figures and situations that populate the background of Zuckmayer's plays. Voigt, the man without a passport, the underdog, rejected and trampled on by society, is the prototype of the "homeless".

(6) In connection with the "Heimat" motif, Zuckmayer's significance as a "writer of folk plays" (as he has often been referred to) and his conception of "folk" is discussed. Contrary to the widely accepted racist and regionalistic interpretation, Zuckmayer presents his own views: "Folk", according to Zuckmayer, is a congregation of independent, self-centered individuals, who are linked together by a common spiritual and emotional experience. What unites them is not the biological, material strength of the blood, but the spiritual force of the common language. Wherever such spiritual tie is lacking, the "folk" turns into a "mass", into an amorphous, hate-driven, incoherent mob.

(7) One of the most characteristic aspects of Zuckmayer's plays is the genuineness and vitality of their characters, - attributes which truly reflect the poet's joy of existence. Zuckmayer's positive attitude toward life goes together with an unbroken faith in destiny. Life and destiny, according to Zuckmayer, cannot be rationally perceived. However, it is within the power of man to sense their innermost manifestations. Man must love his destiny, as he must love life, - in all its beauty and with all its inadequacies.

(8) In conclusion, an attempt is made of exploring the intrinsic meaning and motivation of Zuckmayer's dramatic art. All of Zuckmayer's plays are characterized by a predominance of epical and lyrical elements. This interlacing of the basic dramatic structure in Zuckmayer's plays with non-dramatic elements may be correlated with the poet's attitude toward life and destiny: the epical element, the joy of narrating, would thus correspond to his joy of living, while his striving for dramatic expression may be identified with his desire "to love destiny". For Zuckmayer's amor fati is not spontaneous, but an act of willpower. In his innermost soul, Zuckmayer is aware of the ever present abyss which underlies all forms of existence, and his dramatic endeavour may be interpreted as an attempt to conjure, and finally conquer the danger of despair.

(9) In the second part of this study, a bibliography of works and writings by, and on Carl Zuckmayer, containing a total of about 2,375 entries, is presented.

340 pages. $4.25. Mic 56-841

HENRY JAMES AND AMERICA

(Publication No. 15,797)

Edward Francis Krickel, Jr., Ph.D.
Vanderbilt University, 1955

Supervisor: Professor Richmond Croom Beatty

Critics have never agreed upon the significance America had for Henry James. His attitudes toward it varied over the years. The problem has usually been approached through his fiction, ignoring many pertinent non-fiction works. The purpose of this study is to examine these neglected materials, with attention to chronology, for what they signify. The much-analyzed fiction is given only incidental notice.

A major theme for James was the relation of American artists to their country. Two main ideas were involved — Culture and Subject. At first he thought American deficient in Culture and not worthy as an Artistic Subject. Later his belief was that exceptional persons could compensate for the former, while the latter did not exist fully until created in the work itself.

In examining the literature of his nation, he found the popular feminine writers to be false to observable reality. He insisted that life should be presented wholly and truthfully, though with taste. Such native artists as Hawthorne, Emerson, Lowell, Howells, Norton, Story, and others were found to possess unique American qualities, but also deficiencies. The case of Story illustrated the naivete of his generation in regard to Europe, as well as the perils of foreign residence for an artist. Other émigrés showed the positive side of expatriation. The "American Letters" of 1898 concluded that literary opportunities were vast but were not being realized.

James' mature standard was a coherent blending of many early values. His ideal was a union of American moral qualities with European social forms. Each was insufficient without the other. In The American Scene and related writings, he found his country in a perpetually experimental condition. Great things were still promised, but he feared they would never be achieved.

From the 1890's, he had envisioned closer relations between his homeland and Europe, particularly England. It was seen as a possible model for America's development along the lines of culture. These hopes were blasted by World War I when America did not immediately join the cause of the Allies. James saw this cause as that of civilization itself. He did not survive the conflict.

673 pages. $8.41. Mic 56-842

PIERRE HAMP: HIS LIFE AND WORK

(Publication No. 15,634)

Evelyn Kuhn, Ph.D.
Columbia University, 1955

This is an attempt at a comprehensive study of the life and work of Pierre Hamp (1876-), novelist, dramatist, essayist, and social writer.

Chapter I is devoted to a biography of the author. It attempts to reveal his dominant traits, his intellectual

development and growing social consciousness, his cult of justice and love of trade; and to point out the important early influences - his father's credo, his own apprenticeship as a pastry-cook, and the activities of the anarchists of the 1890's. The effects of his seven years sojourn in England and his stay in Spain are observed; then his subsequent return to France and his attendance of classes at the Université populaire. In 1908 he begins his literary career with Marée fraîche, and receives encouragement to write from Paul Desjardins. In order to earn a livelihood, he works in different capacities - as employee of the Chemin de fer du Nord, as Inspector of Labor, and co-editor of a daily paper - to mention only a few. At the same time he manages to write numerous novels, stories, essays and plays.

Chapter II deals with Pierre Hamp's literary art. Several of his more important works in the La Peine des hommes series are discussed. His deviation from the traditional form of the novel as a genre is noted. He is the inventor of a new sort of novel, without a plot, without a hero. The unity of the work arises out of the "product," or the description of the odyssey of an object from producer to consumer. As a rule his technique is impressionistic. In an attempt to define the merits and demerits of Hamp's style and syntax, it is discovered that many of his shortcomings (neologisms, solecisms, barbarisms) are negligible, and that the roughness and preciosity of his style add force to his work. He may be called a tactile artist. His preoccupation with tangible qualities is revealed in his choice of words and the essential features of his imagery.

The third chapter is devoted to a study of Hamp's aesthetics and polemics. He opposes what he considers the anachronistic standards perpetuated by educational institutions and literary academies, and states his belief that the concept of modern industry can and must bring about a renaissance in art. His views on literary creativity, the function of literature, men of letters, and the commercialization of literature are discussed. This chapter also includes a survey of his views on writers throughout the ages who have dealt with the people.

The final chapter deals with works which are primarily scientific in nature. We note the evolution of Hamp's pessimistic social philosophy to an optimistic one, from despair over the resignation of the working-class and its exploitation by capital prior to World War I to a belief in the people. He makes known the need for a new honor for the working-man and attempts to conciliate the love of work (essentially an artisanal concept) with mechanization. He outlines a program for the advancement of the people, in line with his belief that in a civilization based on labor a social transformation can come about only by the education of the working-class and its eventual participation in the management of economic affairs.

Pierre Hamp has recently seen his contribution to French letters recognized by the French Academy. It is believed that his works will survive for their literary value and their value as documents as well.

282 pages. $3.53. Mic 56-843

THE REPUTATION OF THE PHILOSOPHES IN FRANCE, 1789-1799, AS REFLECTED IN THE PERIODICAL PRESS

(Publication No. 15,748)

Phyllis Susan Robinove, Ph.D.
Columbia University, 1955

The multitudinous citations and discussion of the philosophes in the revolutionary press, the many editions of their works that were published between 1789 and 1799, and the numerous performances of their plays have proved far more extensive than previously suspected. While many journalists praised the philosophes as France's greatest men, others considered them blasphemous creatures who had caused the horrors of the Revolution.

Montesquieu's writings were rarely published in the early years of the decade. Journalists called him a "génie" and hailed the Esprit des lois as his greatest work. Nevertheless, they regarded Montesquieu mainly as a political scientist whose principles were unacceptable as a solution of current problems. After 1795, the year his posthumous works were published, greater interest was evidenced in Montesquieu, whom the revolutionaries particularly lauded for his vigorous style and profundity of thought.

Diderot was discussed a great deal chiefly because three of his major works received their first French publication in 1795 and 1796. The Essai sur la peinture was acclaimed. Two novels received mixed reviews. Some hailed La Religieuse, while those who condemned it accused Diderot of atheism, the chief charge against him at the time. Jacques le fataliste, considered too licentious and trivial by many, had few partisans even among his admirers. Le Père de famille, with one hundred fifty-five performances, proved to be a surprising success in Paris during the revolutionary era. The Mercure de France and the Décade were almost alone in recognizing Diderot's talents. Few others evaluated him as one of the greatest figures of his times.

The revolutionaries considered Voltaire and Rousseau the dominant figures of the century. They constantly lauded Voltaire as a champion of the oppressed, a beneficent man who had done more than anyone else to enlighten men. His works were often republished throughout the decade. Writers also stressed that he had been one of France's greatest poets and dramatists. From 1789 to 1799 nine hundred eighty-four performances of nineteen plays were given in Paris. Brutus, Mahomet, Nanine, Mérope, and Tancrède were the ones most frequently performed. Voltaire was seldom a subject of debate and few articles hostile to him appeared.

Rousseau is the only one whose reputation seems to have been positively affected by the Revolution. He was the object of thirty-two tributes published in the press and the subject of ten plays given in Paris. There seems to have been a concerted effort to honor his memory, the theme of which was that he had been misunderstood in his lifetime and it was for those who had profited by the sublime principles set down in the Contrat social to make amends by paying homage to him. The Contrat social was frequently cited and had twenty-six editions between 1790 and 1798. After the fall of Robespierre, however, Rousseau's political reputation declined notably. In addition to giving attention to his political writings, the journalists manifested great interest in the Confessions, which had many editions, and his personality was widely discussed.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

Other philosophes received little notice, although Mably, Raynal and Helvétius, whose works continued to be published, were singled out as precursors of the Revolution.

The opinions of the majority of the revolutionary journalists lead to the conclusion that it was their earnest belief that the generation of 1789 had to a large extent been molded by the philosophes, but they seemed to find confirmation of their own ideals only in Voltaire and Rousseau.

200 pages. $2.50. Mic 56-844

VOLTAIRE AND THE NEWTONIAN UNIVERSE: A Study of the Eléments de la philosophie de Newton

(Publication No. 13,739)

Robert Lowell Walters, Ph.D.
Princeton University, 1954

Voltaire's interest in science dates from his English visit of 1726-29. He first studied it seriously to write the letters on Newton in the Lettres philosophiques (1734). He learned the important principles of Newton's views and took a stand for Newton against Descartes, whose science was still generally accepted in France. Voltaire's liaison with Madame du Châtelet brought him into a scientific atmosphere, at a time when his studies in metaphysics and history were directing him more and more to science. He became especially anxious over the state of science in France in 1735, when it became a fad in Parisian society. He recognized the need for a popular text that would present the Newtonian view to the French, when Francesco Algarotti arrived at Cirey with the manuscript of his Newtonianismo per le dame, in which he extended attraction to explain the behavior of light and most of the phenomena of nature. This was a far wider application of attraction than Voltaire had known possible.

Voltaire coordinated Algarotti's views into his thinking and at the end of the summer of 1735 conceived the Eléments de la philosophie de Newton. To build up his own scientific structure Voltaire read the principal scientific works of Descartes, Kepler, Huygens, and Newton. He familiarized himself with the Philosophical Transactions of the Royal Society and the Mémoires of the French Academy of Sciences, trying to follow all his ideas to their sources. In Newton the extension of attraction beyond its strict mathematical law was presented in the queries at the end of the Opticks. In spite of insisting on strict scientific proofs Voltaire accepted these queries as true, making them the center of his view.

Voltaire described his world run by attraction for the Cartesian reader of his day. He chose a serious tone, used figures, diagrams, and mathematics as the best means of popularizing the Newtonian truth. He attacked Descartes metaphysically and scientifically to prove that experiment, not reason, was the only road to truth. By making the truth seem paradoxical and illogical, he hoped to clear away his readers' prejudice against attraction.

The influence of Madame du Châtelet on Voltaire's scientific activity has been misjudged. Rather than leading Voltaire, she seems at first to be following him, in optics at least, and then to be contradicting him. Her temporary conversion to Leibnitzian metaphysics caused Voltaire to incorporate in the Eléments a comparison of that view with Newton's.

Voltaire had been drawn to science because attraction at a distance and empty space seemed compatible with Voltaire's arguments for God, formulated in the Traité de métaphysique, and furnished additional reasons for his existence. The closed universes of Descartes and Leibnitz made God unnecessary, Voltaire thought. The Eléments de Newton is therefore, in part, a religious work.

The Eléments de Newton is also a history of science. Voltaire followed the development of scientific ideas, showing the progress science made and the ignorance and superstition against which it had to work. Science as a historic tool for judging the past, for destroying it in favor of the present, and for believing in future progress.

The vision of a world run by attraction, a science as complete as Descartes' had been, proved untenable. Voltaire was forced to admit he had pushed his view of attraction too far. Although he retracted some of his views, nevertheless he had a solid understanding of the real achievements of Newtonian science. Science is important to Voltaire's intellectual growth during the Cirey period and can best be approached through the various editions of the Eléments de la philosophie de Newton.

308 pages. $3.85. Mic 56-845

THE RESOLUTION OF THE FATHER-SON CONFLICT IN THE WORKS OF FRANZ WERFEL

(Publication No. 15,717)

Herbert Frank Wiese, Ph.D.
University of Washington, 1955

The objective of this study is to examine the father-son conflict in toto in the works of Franz Werfel. It was found that no such study had been made previously.

In the earliest works of the author there is a noticeable reticence on the part of Franz Werfel when it comes to the introduction of father-characters. Soon after this, however, he begins to show fathers who are in conflict with their sons. Such conflicts at first seem to be individual and unusual cases, not part of a rebellion of all sons against their fathers.

The rebellion of the sons soon becomes a general revolt of all sons. The author shows his sympathy for the son's rebellion more and more clearly as it builds up in intensity. It reaches a high point just after World War I.

From this time on the violence of the revolt of the sons seems to lessen as the author experiments, in his works, with various possible solutions to the problem of the father-son conflict.

When the sons realize that they themselves are potentially fathers and that the fathers at one time were sons, there is a tendency for the bitterness between the generations to be lessened somewhat.

At one time there is a hope expressed by Werfel's characters that men can work out their own problems, including the generations problem.

As this hope grows ever dimmer there is a turning to Christianity on the part of the author, which he expresses in the characterization of saints and prophets, who, through complete surrender to the Father, avoid conflict with Him.

Throughout the years after the peak period of the sons' revolt, the father is portrayed ever more sympathetically by Werfel. The revolt of the sons, once hailed as the only hope for freedom, is later rejected by the author. Now it is the father who is portrayed as the defender of the family against tyranny, which threatens the family from without.

The final resolution of the father-son conflict comes late in the author's works. What has been achieved in a moment of "inspiration" in Die vierzig Tage des Musa Dagh (1933), when father and son are united through death and self-sacrifice, is achieved permanently by the father and son in Der Stern der Ungebornen (1945). Here all time and space barriers are removed and fathers and sons are united forever in what the author calls Gleichzeitigkeit or "simultaneousness."

But this solution can be achieved only by the "initiated" and then only with the greatest of effort and difficulty. The son in Der Stern der Ungeborenen must voluntarily accept pain and death, when both are permanently avoidable for him, in order to bring about the solution of the father-son conflict. 209 pages. $2.61. Mic 56-846

THE MINOR POEMS OF SIR WILLIAM D'AVENANT: EDITED WITH CRITICAL INTRODUCTION AND NOTES

(Publication No. 15,644)

Matthew Montgomery Wise, Ph.D.
Columbia University, 1955

Sir William D'Avenant (1606-1668), as a poet, merits a larger recognition than he has received, for his conception of the nature of poetry and of the poetic imagination as expressed in his verse illuminates the transition from Jacobean to Restoration poetic style more clearly, perhaps, than does the work of any other contemporary. Ironically, those poems which are most interesting as the vehicles for his serious ideas and as an anticipation of future developments are often least rewarding as poetry.

Though predominantly occasional, his verse exhibits considerable range and variety, in satirical, philosophical, and narrative veins; however, his lyrics represent his principal and only consistently satisfying achievement. His style owes much to Jonson in its firm, even prosaic regularity and occasional roughness. A sober earnestness weighs down many poems because D'Avenant, trying to advance in the world by means of his verse, took his verse too seriously; but characteristic and effective light touches occur in frequent humorously pathetic personal allusions to his trials and infirmities. Despite some "metaphysical" images in earlier poems his imagination was not very fertile; to compensate he resorted to repetition of conventional images.

In the realm of ideas D'Avenant experienced something like an intellectual awakening about 1637. A dominant theme is a pervasive anti-scholasticism coupled with a persistent aversion to artifice (the insistence that truth should be expressed in an unadorned style) that anticipates later critical shifts. His intellectual activity was intensified by a fruitful association with Thomas Hobbes (1648-1650), who clearly influenced D'Avenant. In their important pronouncements on wit, fancy, and judgment in the Preface to Gondibert and Hobbes's Reply, however, D'Avenant exercised the influence. In several early allusions to wit D'Avenant equated it with judgment; in the Gondibert Preface and in later poems wit is equivalent to discretion or decorum. In Hobbes's single early allusion to the faculties they are distinguished by their capacity for comparing, but in his Reply and thereafter Hobbes adopted D'Avenant's meaning.

In his increasing exaltation of the rational faculty over the imaginative and spiritual D'Avenant was promoting a dissociation of sensibility. The predominantly ornamental imagery most clearly demonstrates the separation of form and matter and, with diction, the tendency from the unusual to the conventional, from extravagance to restraint. He points toward the Restoration, furthermore, in his observance of propriety, in his increasing use of abstractions, and in his development of the closed neo-classical couplet.

D'Avenant is worth remembering not only for his historical significance, but for a handful of carefully wrought poems that compare favorably in number and quality with those of his more celebrated court contemporaries. If he had cultivated the delicate lyric instead of Fame, his fame would have been more firmly established.

The textual problems principally concern the three editions of Madagascar, 1638, 1648, and the Folio of 1673, which also contains the only authoritative text of his "Poems on Several Occasions." Although the Folio was published after D'Avenant's death, it is clear that he prepared the material for the press, for many of the poems, as well as selections from plays, contain evidence of authorial revision. The text for the Madagascar poems is based on the first edition, with the alterations which the poet subsequently made.

As for the canon, the edition contains, besides the published non-dramatic verse and poems from plays, seven poems never before printed with D'Avenant's works, five from manuscript, two from song-books. The apparent spuriousness of five others has been demonstrated.

The poems are in chronological order with full textual and commentary notes. 727 pages. $9.09. Mic 56-847

VARIÉTÉS LOCALEMENT PLATES

(Publication No. 13,666)

Jean Paul Benzécri, Ph.D.
Princeton University, 1955

The study of locally flat affine varieties originates in that of metrically flat varieties. For these varieties, there exists, in some neighborhood of each point, an isometric map into euclidean space. We may try to extend such a map to the whole variety by developing, in the euclidean space, the various curves originating in the region already mapped. It turns out that, from one given region, we get by extension, various mappings, each pair of which differ by an isometric transformation associated with the homotopy class of the path connecting the two maps. Moreover, the development covers the whole of the euclidean space: it is a one-to-one representation of the universal covering of the variety, which turns out therefore to be the quotient of the euclidean space by the group of isometric transformations connecting pairs of maps of the same region.

For affine varieties, the universal covering does not always map onto the whole space; the mapping is not always one-to-one. Actually, in dimensions higher than two, the classification of such mappings is an open problem.

On a two-dimensional variety, lines may be drawn, the so-called retro-sections, such that their points form a connected curvilinear polygon, whose boundary is each line counted twice, and which has actually only one vertex, counted several times. The polygon of a metric surface can be developed on the plane; being simply-connected it is mapped one-to-one; the sides are pairs of equal lines; the sum of the angle at the vertices, which are obtained by splitting up the neighbourhood of one particular point on the surface, is 360^0. Since the boundary can be reduced without cusps to a small circle, the rotation of the tangent round the boundary is 360^0. Consequently, the polygon must be 4-sided.

In the affine case, the mapping is no longer one-to-one. However, the development from one point remains well-defined, since the polygon is simply connected. The rotation of the tangent is 360^0, whatever quadratic form is chosen as a metric. The coupled sides are not equal but they are linearly equivalent, which makes the evaluation of the corresponding rotations more involved. Inequalities arise involving the measure in half-turns of the curvature of the sides, and finally the result is the same. Topologically, a compact affinely flat surface is either the torus, or the one-sided surface it covers.

This topological fact allows us to study completely the group of transformations connecting two different maps obtained by extension from the same open set. This group is an affine representation of the fundamental group, which is now well-known.

From the nature of these groups, it turns out that the structure of the surfaces is richer than expected: classification can be completed, using a decomposition of the surfaces into a finite number of components, on each of which a metric can be canonically defined.

63 pages. $1.00. Mic 56-848

THE GREEN'S AND NEUMANN'S PROBLEMS FOR DIFFERENTIAL FORMS ON RIEMANNIAN MANIFOLDS

(Publication No. 13,679)

Pierre Euclide Conner, Jr., Ph.D.
Princeton University, 1955

In this work we shall be concerned primarily with differential forms and their boundary values on Riemannian manifolds. Much attention has been given this question, particularly by Duff, Garabedian and Spencer. Gaffney also framed in Hilbert space language some of the boundary value problems treated in the classical manner by the previously mentioned authors.

Our work is largely motivated by algebraic topology and is concerned with a new generalization of the classical Green's and Neumann's problems for functions to differential forms on a manifold. Indeed we express Neumann's problem for forms on a manifold with boundary as finding a solution of

$$\Delta \zeta + s\zeta = 0$$

with $n\zeta$ and $nd\zeta$ prescribed on the boundary, where $n\zeta$ and $nd\zeta$ are the normal component and normal derivative respectively on the boundary. The Green's problem consists in finding a solution of

$$\Delta \zeta + s\zeta = 0$$

with $t\zeta$ and $t\delta\zeta$ prescribed on the boundary, where $t\zeta$ and $t\delta\zeta$ are the tangential component and tangential coderivative respectively. These problems are readily seen to be equivalent.

We begin with a Hilbert space treatment obtaining a partial generalization of Hodge's theorem to arbitrary manifolds by showing that for a norm finite closed form on the manifold there is a norm finite harmonic field having the same periods on compact cycles. It is also shown by operator algebra that the Neumann's problem for forms as introduced by Spencer is implied by the problem we consider here.

A proof of the Hodge theorem on a manifold with boundary and of the Lefschetz duality theorem is an immediate consequence of our treatment of these boundary value problems. An application of these results is made to the problem of a Lie group acting as a group of C^{ω} isometries on a manifold with boundary. It is shown that if the group is transitive on each boundary component, then every l-cycle in the manifold is homologous to a l-cycle in the boundary. Furthermore, if the group is abelian and transitive on

each boundary component then every p-cycle in the manifold is homologous to a p-cycle in the boundary.
93 pages. $1.16. Mic 56-849

EQUICONTINUITY IN DYNAMICAL SYSTEMS

(Publication No. 14,958)

Charles Henry Cunkle, Ph.D.
University of Missouri, 1955

Supervisor: W. R. Utz

If a group of homeomorphisms of a metric space into itself is equicontinuous at one point of an orbit, it is equicontinuous at every point of the orbit. If the group is equicontinuous on the space, then each orbit closure is minimal with respect to the property of being closed and invariant, and thus the orbit closures give a minimal set decomposition. The transformation group is almost periodic, recurrent, or non-wandering on the entire space whenever it has the corresponding property on some dense subset, and in the case of equicontinuity, a similar result is found for pointwise almost periodicity, etc. The limit inferior of a collection of orbits is a minimal set whenever the transformation group is equicontinuous on the limit inferior. If Y is a set of points each sequence of which converges to x, a point of equicontinuity, then the orbit closure of x is the limit of the collection of orbits of points of Y. In case the transformation group is isomorphic to a subgroup of the additive group of the reals, a number of special results are found. In the case of equicontinuity, if an orbit has either an ω-limit point or an α-limit point, then each point of the orbit closure is both an ω-limit point and an α-limit point. For subgroups of the reals a weakening of the definition of equicontinuity is shown. In addition, a property somewhat weaker than equicontinuity is found sufficient in many cases. Eleven counterexamples illustrate both the strength and the limitations of many of the hypotheses. 41 pages. $1.00. Mic 56-850

ON GENERALIZATIONS OF ABSOLUTE AND STRONG CESÀRO SUMMABILITY

(Publication No. 14,401)

Leonard Irvin Holder, Ph.D.
Purdue University, 1955

Major Professor: A. H. Smith

In this thesis definitions are given for absolute and strong summability with respect to the (α,β) method of summability introduced by L. S. Bosanquet and E. H. Linfoot [Quart. Jour. Math. (Oxford Series) 2 (1931) 207-229 and Jour. London Math. Soc. 6 (1931) 117-126], and various properties and applications of these concepts are investigated.

Let Σa_n be a given series, α and β be two real numbers, and

$$A^{(\alpha,\beta)}(\omega) = \sum_{n<\omega} B\left(1 - \frac{n}{\omega}\right)^{\alpha} \log^{-\beta} \frac{C}{1 - \frac{n}{\omega}}\, a_n$$

where $\omega > 0$, C is an arbitrary positive constant, and $B = \log^{\beta} C$. The definitions are:

Definition A. The series Σa_n is said to be absolutely summable (α,β), or summable $|\alpha,\beta|$, where $\alpha > 0$ or $\alpha = 0$, $\beta > 0$, if there exists an $a \geqq 0$ such that for each sufficiently large C,

$$\int_a^{\infty} \left|\frac{d}{d\omega} A^{(\alpha,\beta)}(\omega)\right| d\omega < \infty .$$

Summability $|0, 0|$ is defined as absolute convergence.

Definition B. The series Σa_n is said to be strongly summable (α,β) with index p, or summable $[\alpha,\beta; p]$, to the sum S, if Σa_n is summable (α,β) to S, and for all sufficiently large C,

$$\int_1^{\omega} \left| u \frac{d}{du} A^{(\alpha,\beta)}(u)\right|^p du = 0(\omega)$$

as $\omega \longrightarrow \infty$, where $p \geqq 1$ and either $\alpha > 0$ or $\alpha = 0$, $\beta > 0$.

Summability $|\alpha, 0|$ is identical to absolute Rieszian summability, $|R,\alpha|$, hence equivalent to absolute Cesàro summability, $|C,\alpha|$, [see J. M. Hyslop, Proc. Edin. Math. Soc. (2) 5 (1936) 46-54]. Similarly, $[\alpha, 0; p]$ summability is identical to strong Rieszian summability, $[R;\alpha, p]$, and equivalent to strong Cesàro summability, $[C;\alpha, p]$, for $p \geqq 1$ [see A. V. Boyd and J. M. Hyslop, Proc. Glasgow Math. Assoc. 1 (1952) 94-99].

In Part I certain properties of $|\alpha,\beta|$ and $[\alpha,\beta; p]$ summability are investigated. With regard to absolute summability it is proved that: (i) $|\alpha,\beta|$ summability implies (α,β) summability, but not conversely; (ii) that absolute convergence implies summability $|\alpha,\beta|$ for $\alpha > 0$ or $\alpha = 0$, $\beta > 0$; (iii) that $|C, 1|$ summability implies $|\alpha,\beta|$ summability for $\alpha > 1$ or $\alpha = 1$, $\beta > 0$; (iv) that for $\alpha > 1$ or $\alpha = 1$, $\beta > 0$ the condition

$$(*) \qquad \frac{d}{d\omega} A^{(\alpha,\beta)}(\omega) = 0(F(\omega))$$

where $F(\omega) \in L(a, \infty)$ and $\omega^3 F(\omega)$ is monotone increasing, implies not only $|\alpha,\beta|$ but also $|\alpha',\beta'|$ summability for $\alpha' > \alpha$ or $\alpha' = \alpha$, $\beta' > \beta$. It is shown that necessary conditions for $[\alpha,\beta; p]$ summability are that either $\alpha > \frac{1}{p'}$, or $\alpha = \frac{1}{p'}$, $\beta > \frac{1-\delta}{p}$, where $\frac{1}{p} + \frac{1}{p'} = 1$, $\delta = 0$ if $p > 1$ and $\delta = 1$ if $p = 1$. Further, it is shown that: (i) (α,β) summability does not imply $[\alpha,\beta; p]$ summability; (ii) that $[\alpha,\beta; p]$ implies $[\alpha,\beta; q]$ to the same sum, provided $1 \leqq q < p$; (iii) and that under a condition similar to (*), $[\alpha,\beta; p]$ implies $[\alpha',\beta'; q]$ for $\alpha > 1$ or $\alpha = 1$, $\beta > 0$, $\alpha' > \alpha$ or $\alpha' = \alpha$, $\beta' \geqq \beta$, and $1 \leqq q \leqq p$. Also, in Part I, it is proved that $|\alpha,\beta|$ summability implies $[\alpha,\beta; p]$ summability for $p = 1$ but not for $p > 1$, and that $[\alpha,\beta; p]$ summability does not imply $|\alpha,\beta|$ summability.

In Part II some applications of the methods to the theory of Fourier series are given. The principal results are:

Theorem I. If $\alpha \geqq 0$ and $\varphi_\alpha(t)$ is of bounded variation in $(0,\pi)$, then the Fourier series of f(t) is summable $|\alpha,\beta|$ at the point $t = x$ for every $\beta > 1$ if $\alpha = 0$ and $\beta > 2$ if $\alpha > 0$.

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Theorem II. If $\alpha \geqq 0$ and $\psi_\alpha(t)$ is of bounded variation in $(0,\pi)$ and $\theta_\lambda(t)$ is of bounded variation in $(0,\pi)$ for some positive λ, then the conjugate Fourier series of f(t) is summable $|\alpha,\beta|$ at the point t = x for every $\beta > 1$ if $\alpha \neq 1$ and $\beta > 2$ if $\alpha = 1$.

Also proved are

Theorem III. If $\alpha > 1$ or $\alpha = 1$, $\beta \geqq 0$ and the Fourier series of f(t) satisfies the condition (*) at the point t = x, then $\varphi_{\alpha+1+\gamma}(t)$ is of bounded variation in $(0,\pi)$ for every $\gamma > 0$.

Theorem IV. If $\alpha > 1$ or $\alpha = 1$, $\beta \geqq 0$ and the conjugate Fourier series of f(t) satisfies the condition (*) at the point t = x, then $\theta_{\alpha+\gamma}(t)$ is of bounded variation in $(0,\pi)$ for every $\gamma > 0$.

Under the same hypotheses as Theorems I and II the Fourier series and conjugate series respectively are shown to be summable $[\alpha,\beta;\ 1]$.

In the above theorems the following definitions are used:

$$\begin{cases} \varphi(t) = \frac{1}{2}\{F(X+t) + F(X-t)\}\ ,\ \psi(t) = \frac{1}{2}\{F(X+t) - F(X-t)\} \\ \theta(t) = \int_t^\infty u^{-1}\psi(u)du \end{cases}$$

and

$$\begin{cases} \Phi_\alpha(t) = \frac{1}{\Gamma(\alpha)}\int_0^t (t-u)^{\alpha-1}\varphi(u)du\ ,\ \alpha > 0\ ;\ \Phi_0(t) = \varphi(t) \\ \varphi_\alpha(t) = \Gamma(\alpha+1)\, t^{-\alpha}\, \Phi_\alpha(t)\ ,\ \alpha \geqq 0 \end{cases}$$

with $\psi_\alpha(t)$ and $\theta_\alpha(t)$ defined similarly.

123 pages. $1.54. Mic 56-851

METRIC FOUNDATIONS OF ELLIPTIC 2-SPACE

(Publication No. 14,964)

Theral Orvis Moore, Ph.D.
University of Missouri, 1955

Supervisor: Leonard M. Blumenthal

The objective of this study is to show that the postulates 1-4 listed below are logically equivalent to a set of 18 axioms shown by E. Podehl and K. Reidemeister in 1934 (Abhandlungen aus dem Mathematischen Seminar, Hamburg) to be foundations for two-dimensional elliptic geometry. The four postulates are as follows:

1. S is a complete convex semimetric space (containing at least two distinct points) with diameter at most $\pi r/2$ (where r is a given positive number).

2. If p_0,p_1,p_2,p_3,p_4 are five pairwise distinct points of S with (1) two triples linear and (2) the determinant Δ^* formed for three of the points (one of which is common to the two linear triples) negative, then an epsilon matrix (ϵ_{ij}) exists such that all principal minors of the determinant

$$\left|\epsilon_{ij}\cos(p_ip_j/r)\right| \quad (i,j = 0,1,2,3,4)$$

are non-negative.

(The determinant Δ^* formed for the three points q_1,q_2,q_3 is the determinant

$$\begin{vmatrix} 1 & \cos(q_1q_2/r) & \cos(q_1q_3/r) \\ \cos(q_1q_2/r) & 1 & -\cos(q_2q_3/r) \\ \cos(q_1q_3/r) & -\cos(q_2q_3/r) & 1 \end{vmatrix}.$$

An epsilon matrix is a symmetric square matrix (ϵ_{ij}) $(i,j = 1,2,\cdots,n)$ with $\epsilon_{ij} = \pm 1$ $(i,j = 1,2,\cdots,n)$ and $\epsilon_{ij} = +1$ for i = j.)

3. If $p,q \in S$ with $0 \neq pq \neq \pi r/2$, then points p^*,q^* of S exist such that pqp^* and qpq^* hold, with $pp^* = qq^* = \pi r/2$.

4. The following statement is valid for n = 2 but not valid for n = 1: if $p_0,p_1,\cdots,p_{n+1}$ are any n + 2 points of S for which an epsilon matrix (ϵ_{ij}) exists such that no principal minor of

$$\left|\epsilon_{ij}\cos(p_ip_j/r)\right| \quad (i,j = 0,1,\cdots,n+1)$$

is negative, then there exists an epsilon matrix for which the determinant vanishes and has no principal minor negative.

The primitive notions used by Podehl and Reidemeister are point, line, incidence, perpendicularity, and congruence, while the only primitive notions used in this thesis are point and distance.

Each primitive notion of Podehl and Reidemeister is defined in this study and each axiom of those writers is shown to be a consequence of postulates 1-4. It is then noted that the system axiomatized by those writers is identifiable with the two-dimensional elliptic space $E_{2,r}$, in which postulates 1-4 are satisfied. Thus the final conclusion is that postulates 1-4 define a space whose metric geometry is logically equivalent to the geometry of the elliptic plane. 59 pages. $1.00. Mic 56-852

MINERALOGY

AN EXPERIMENTAL INVESTIGATION ON THE SURFACE REACTIONS OF FELDSPARS

(Publication No. 14,965)

Victor Nash, Ph.D.
University of Missouri, 1955

Supervisor: C. E. Marshall

This investigation can be rather conveniently divided into two sections. The first part was concerned with the interaction of the surfaces of the various feldspars with acids. From this it was possible to learn something about the relative stability of the feldspars in acids. The second part was concerned with the interaction of salts with the feldspar particles. Further, along with this it was possible to study the cationic exchange properties of their surfaces.

In order to attain the objective set down above, the following procedures, measurements, and comparisons were carried out. The feldspars were reduced to a small size by grinding in a ball mill, containing benzene to prevent hydrolysis. The mineral particles were separated into five fractions by dispersing in water and separating by sedimentation and centrifugation. The pH and sodium activity were determined when the hydrogen systems were titrated with bases. The release of ions by hydrochloric acid were measured. Measurements were made on the reactions of albite and anorthite with solutions of ammonium, strontium and magnesium chlorides. A comparison was made of the relative stability of the feldspars to hydrochloric acid and ammonium chloride. Measurements were made of the cation exchange properties of all the feldspars, including cation exchange capacities for strontium, ammonium, magnesium, and potassium; activities of strontium, magnesium, and potassium; bonding energy of strontium, magnesium, and potassium; and determination of the elements released from the lattice by ammonium chloride treatments.

This work has shown very well the importance of cation exchange in the decomposition of feldspars. The cations in salt solutions can replace the cations in the lattice of the mineral thus causing decomposition. Along with this decomposition a silica-alumina layer is built up around the mineral particles. Subsequent decomposition is then controlled to a large extent by the cation exchange properties of this silica-alumina layer, and the ability of cations to diffuse through it. 156 pages. $1.95. Mic 56-853

PHARMACOLOGY

THE RELATIONSHIP BETWEEN SODIUM AND POTASSIUM TRANSPORT AND CHOLINESTERASE ACTIVITY IN KIDNEY CORTEX SLICES FROM NORMAL AND ADRENALECTOMIZED RATS

(Publication No. 15,792)

Mary Kathleen Carter, Ph.D.
Vanderbilt University, 1955

Supervisors: Dr. Allan D. Bass and Dr. Margaret E. Greig

Previous investigations by Greig and Carter have shown that the cholinesterase activity of kidney from adrenalectomized rats was decreased when compared to normal tissue. This decreased activity was restored toward normal values with certain steroids in an in vitro system. Desoxycorticosterone increased the activity when the substrate was benzoylcholine or butyrylcholine. Adrenal cortex extract, Compound F or ouabain increased the activity when the substrate was acetyl-β-methylcholine or 5×10^{-3} M. acetylcholine. These compounds either had no effect or depressed the cholinesterase activity of normal kidneys. It had been shown by Greig and co-workers that an active cholinesterase is a significant factor in the maintenance of the normal permeability of certain tissues.

The aim of the present investigation was to see if some relationship existed between the decreased cholinesterase activity of the kidney of adrenalectomized rats and the defect in sodium and potassium excretion present in adrenal insufficiency. The approach used was to see if the behavioral pattern of sodium and potassium movements in slices of rat kidney cortex from normal and adrenalectomized rats could be correlated with the decreased cholinesterase activity in adrenalectomized rat kidneys.

It was found that normal rat kidney cortex slices incubated at 37° C. in the presence of oxygen in a Krebs Henseleit bicarbonate saline containing 10 mM. α-ketoglutarate and 13 mM. potassium lost about 50 milliequivalents of potassium per kilogram (dry weight) for the first five minutes and then regained this amount over the next 40 to 50 minutes. Acetylcholine (1×10^{-2} M.), included in the medium, delayed the uptake of potassium for the first 30 minutes. Measured at the 50 minute interval there was about 40 milliequivalents per kilogram less potassium in the acetylcholine treated slices. Control slices gained sodium continuously on incubation. Acetylcholine did not produce a significant increase in the gain of sodium.

Kidney cortex slices from adrenalectomized rats failed to regain all the potassium lost in the first five minutes of incubation. There was 25 milliequivalents per kilogram

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less potassium, than originally present, in the slices after 50 minutes incubation. In the kidney cortex slices from adrenalectomized rats acetylcholine had an increased effect on the loss of potassium at the 5 minute interval. However, after this increased loss at the 5 minute interval there was no delay in the uptake of potassium as was observed in acetylcholine treated normal rat kidney slices. These data suggest that the hydrolysis of acetylcholine may be related in some way to the transport of potassium in normal rat kidney cortex slices.

Physostigmine, an inhibitor of cholinesterase, in concentrations of 1×10^{-3} and 5×10^{-3} M. inhibited rat kidney cholinesterase from 50 to 75%. In these concentrations physostigmine lessened the effect of acetylcholine in delaying the uptake of potassium in normal slices. This could also substantiate the idea that an active cholinesterase plays some role in the delay of potassium uptake.

Other choline esters as acetyl-β-methylcholine and benzoylcholine produce qualitatively the same effects as acetylcholine but differ quantitatively. Butyrylcholine had no effect on sodium and potassium movements.

Desoxycorticosterone (7.5×10^{-6} M.) did not cause a significant increase in the activity of acetylcholine in delaying the uptake of potassium in kidney cortex slices from adrenalectomized rats. Under the present experimental conditions used, Compound F had no effect on sodium and potassium transfers in slices of kidney cortex from adrenalectomized rats.

Synthesis of a substance (presumably acetylcholine) was obtained using a 10% suspension of rat kidney in choline, acetate and TRIS buffer. Synthesis occurred better at pH 5.0 than at higher pH's. 108 pages. $1.35. Mic 56-854

morphine sulfate required to completely prevent respiratory depression by 5 mg./Kg. of the latter drug given intravenously to dogs is 1.0: 7.1.

It seems likely that nalorphine antagonizes the respiratory depressant effects of morphine by a mechanism other than true competitive inhibition. It appears to be a pharmacodynamic agent in its own right, which acts centrally on the respiratory centers in overcoming morphine depression. Nalorphine, however, does not alter the responsiveness of the non-depressed inspiratory center of the dog to electrical stimulation. The stimulatory effect of nalorphine against morphine is not altered after complete bilateral vagotomy and bilateral carotid body denervation.

Nalorphine inhibits the depleting effect of morphine on adrenal ascorbic acid. However, combinations of morphine and nalorphine in high doses may act synergistically in depleting adrenal cholesterol in albino rats. It was found that the integrity of the adrenal glands is necessary for the action of nalorphine in combating the acute toxic effects of morphine in rats.

In summary, it may be concluded that nalorphine is active against a wide variety of narcotic, and certain barbiturate, depressants. It acts directly on the depressed inspiratory center, increasing its sensitivity to electrical and, most probably, normal physiological stimuli. Its antagonistic effects may be mediated in part by an action upon the adrenal cortex either directly or indirectly. Further investigation will be necessary before a final statement can be made concerning the site and mechanism of action of nalorphine. 153 pages. $1.91. Mic 56-855

A PHARMACOLOGICAL STUDY OF THE SITE AND MECHANISM OF ACTION OF N-ALLYLNORMORPHINE

(Publication No. 15,833)

Fred Theodore Galysh, Ph.D.
The Ohio State University, 1955

An investigation was made of the antagonism by N-allylnormorphine (nalorphine) of the undesirable depressant effects of morphine, and an attempt was made to partially elucidate the site and mechanism of action of the former drug.

Experiments were performed to determine the minimum dose of nalorphine sufficient to prevent respiratory depression by a chosen dose of morphine in dogs. Further studies, utilizing direct electrical stimulation of the medullary inspiratory center, were made in intact and chemoreceptor-denervated animals. In these studies the inspiratory volume response to electrical stimulation, as well as minute volume, was measured. Finally, an investigation was made of the importance of the pituitary-adrenal axis with regard to the antagonistic action of nalorphine.

It was found that nalorphine antagonizes respiratory depressant effects of certain barbiturates, namely, amobarbital and pentobarbital, in dogs. However, nalorphine does not improve respiration in dogs anesthetized with urethane or secobarbital.

The optimal dosage ratio nalorphine hydrochloride:

A PHARMACOLOGICAL EVALUATION OF ANTIHYPERTENSIVE AGENTS

(Publication No. 15,865)

John Randolph Murray, Ph.D.
The Ohio State University, 1955

The purpose of the investigation was to develop a suitable screening method for compounds having potential antihypertensive activity.

Included in the introduction is a brief discussion of human hypertension and modern antihypertensive drugs; experimental hypertension is discussed under the headings: history, pathogenesis, production, and measurement.

The experimental animal used was the white rat, since it is relatively inexpensive and readily available. Hypertension was produced by placing a figure-of-eight ligature on one kidney plus contralateral nephrectomy (Grollman's technique). The Photoelectric Tensometer (Metro Industries) was used in making indirect blood pressure measurements by the foot-cuff method of Kersten (1947). To test the method, drugs with proven antihypertensive activity and differing in their modes of action were selected; they were: sodium azide, 1-hydrazinophthalazine, hexamethonium bromide, and reserpine. Preliminary tests were done on sodium azide and 1-hydrazinophthalazine combined.

It was shown that male rats developed hypertension more readily than did females, but there was no sex difference in the drug responses.

All of the drugs tested depressed the blood pressure of the hypertensive more than that of the normotensive animal.

The rapidity of onset and duration of action of drugs in the experimental animals was similar to that observed clinically.

Other screening methods for antihypertensive drugs are discussed; in comparison, this new method exhibited the following advantages:

a) it employs the rat, which is readily available and in which hypertension may be easily produced;
b) it is economical, because the animals and apparatus are relatively inexpensive, measurements are made rapidly, and only small amounts of drug are required;
c) it measures the effects of all types of antihypertensive drugs;
d) large numbers of tests may be conveniently run, and the results subjected to statistical analyses;
e) the same animal may be used for intermittent or prolonged testing of drugs.

The conclusions reached were:

1) A new method for screening antihypertensive drugs has been developed. It has been tested successfully with different types of antihypertensive drugs having clinically proven antihypertensive activity. 2) As well as being useful in screening for antihypertensive activity per se, this method can be used also to show the nature of the antihypertensive action, e.g., the rapid onset and short duration of action of sodium azide, the delayed onset and prolonged action of Apresoline, and the very slow onset of action of reserpine. The method is therefore further recommended, in view of its adaptability, for pharmacological testing of the quantitative effects of antihypertensive drugs. 3) Hypertensive male rats should be used as the test animal, normotensives serving as controls. 4) The promising results obtained with a drug combination indicate that the method should be of value in testing drugs in combination as well as individually. 90 pages. $1.13. Mic 56-856

THE ROLE OF THE VAGI AND CAROTID SINUS MECHANISMS IN RAUWOLFIA SERPENTINA HYPOTENSION IN DOGS

(Publication No. 15,886)

Carl Alvin Schlagel, Ph.D.
The Ohio State University, 1955

A study has been made to determine the role which the vagi and afferent nerve endings of the carotid bifurcation play in the antihypertensive action of the alkaloids of Rauwolfia serpentina. In the first phase of the work, 1.0 mg./Kg. of the alseroxylon alkaloids was injected intravenously into four groups of dogs and the effects noted over a six-hour observation period. In all of these animals, the characteristically delayed but progressively developing and prolonged hypotension was observed. In normal, vagotomized, and carotid denervated dogs, the femoral arterial blood pressure fell to approximately the same level, while a considerably lower nadir was observed in dogs which had both the vagi and carotid areas denervated. The same degree of bradycardia and respiratory depression occurred in all of the animals irrespective of their surgical background. In the normal and vagotomized animals the carotid occlusion pressor response was considerably blocked, and in a few of the animals it was converted into a diphasic response (depressor, then pressor).

These results indicate that (1) the vagi do not solely determine the degree of bradycardia produced by the Rauwolfia alkaloids, (2) the degree of bradycardia does not determine the final hypotensive blood pressure levels, and (3) neither the vagi nor the carotid area receptors alone contribute to the centrally elicited Rauwolfia hypotension. Instead, these nervous mechanisms act in their normal capacity as buffers to prevent the blood pressure from falling to the lower levels which ensue when both of these nervous pathways are denervated.

In the second phase of the investigation, the alseroxylon alkaloids, reserpine, epinephrine, and $NaNO_2$ in 0.1 ml. solutions were injected into the muscular adventitia (intercarotid) of the carotid bifurcations of vagotomized dogs. Intercarotid doses of 1.0 to 150 mcg. of the alseroxylon alkaloids and reserpine produced only mild and transient hypertension. Because of its relative insolubility, larger doses of reserpine could not be employed. However, 250 to 500 mcg. of the alseroxylon alkaloids produced marked hypertension, with an occasional complete blocking of the carotid occlusion pressor response. These same doses of the alseroxylon alkaloids blocked or reversed the hypotension elicited by previous and similarly injected epinephrine. Neither the chemoreceptors nor the alseroxylon vehicle was involved in this alseroxylon-induced hypertensive action. A local anesthetic action was also unlikely.

In dogs which were orally treated with the alseroxylon alkaloids or reserpine for a period of ten days, the hypertension produced by carotid occlusion or by 250 to 500 mcg. of intercarotid alseroxylon was almost completely blocked. In these same orally treated animals, intercarotidly injected epinephrine produced a profound rise in the femoral arterial pressure which was unaltered by intercarotidly injected alseroxylon or by complete carotid area denervation. If these orally treated animals were also given intravenous Dibenamine, the intercarotid epinephrine pressor action was violently converted to a depressor response. While intercarotidly injected vasopressin and $NaNO_2$ always produce a fall and rise in blood pressure, respectively, in normal dogs, the blood pressure effects of these drugs were always reversed in the Rauwolfia animals that were orally treated.

An analysis of these results permits the following conclusions: (1) the conclusions of other investigators that Rauwolfia hypotension is produced by a central blocking of sympathetic impulse outflow are confirmed; (2) the hypertension elicited by intercarotidly injected alseroxylon alkaloids, both before and after similarly injected epinephrine, is due to a direct vasodilatory action of these alkaloids on the carotid pressoreceptors and not to an adrenolytic action; (3) the degree of central sympathetic blockade, the action of the Rauwolfia alkaloids on the carotid pressoreceptors, and the normal physiological role of the sino-aortic pressoreceptors are the three factors which collectively determine the final hypotensive blood pressure level produced by the Rauwolfia alkaloids; and (4) the marked pressor response following intercarotid epinephrine is due to the fact that a portion of the dosage enters the blood stream, to a sensitization of the sympathetic effector end organs (to this exogenous epinephrine) resulting from a Rauwolfia-engendered pharmacological sympathectomy, and to the central Rauwolfia sympathetic blockade which is analogous to and which nullifies the epinephrine-induced, carotid pressoreceptor activity. 134 pages. $1.68. Mic 56-857

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IMMEDIACY AND IMMUTABILITY: A STUDY IN THE THEORY OF KNOWLEDGE

(Publication No. 15,825)

John De Lucca, Ph.D.
The Ohio State University, 1955

The essay contends that in order to distinguish knowledge from belief and probability, it must be identified with certainty. In order for probability to be a significant notion, it must be based upon a prior certainty. Certainty of knowledge of the external world requires a relation of immediacy between the knower and the known during the moment of perception. But if indubitability is restricted to the data of the senses, we can not account for perceptual unity, for causal explanations, for the import of judgment, and for the fact of universal concepts. Since discursive reasoning must involve universality, which cannot be supplied by sense perception, there must be a non-empirical, determinate ground of universality. Thus, the conception of the certainty of knowledge entails two requisite factors: (1) a relation of immediacy between the knower and the known, and (2) a determinate, fixed ground that is common to all men. Provision for the first factor is referred to as a "principle of immediacy," and provision for the latter factor as a "principle of immutability." It is the thesis of this essay that these factors of immediacy and immutability are the minimal requisites for a theory assuring the certainty of knowledge of the external world.

That both of these principles are essential for an adequate theory of knowledge is shown by examining various types of positions with respect to each principle. Failure to make provision for the principles of immediacy and of immutability is shown to lead to skepticism concerning the possibility of knowledge of things themselves, or to some variety of probabilism.

Consideration of the principle of immediacy proceeds by examining typical proffered theories concerning the structure of the knowledge relation. These theories are differentiated in terms of whether or not they affirm immediacy of relation between the knower and the known during the moment of perception. When immediatism is denied, the kinds of mediating elements and the consequences of such mediation are examined. Positions considered with respect to this aspect of the problem of knowledge include those of Plato, Aristotle, Locke, Berkeley, Hume, Kant, Reid, Bradley, and Dewey.

The principle of immutability is investigated by discriminating the possible loci and forms of the common, determinate grounds requisite for certainty and universality. The only significant loci for this factor are external things or what is known, or else the mind or knower. Since these divergent positions are best formulated in Aristotle's doctrine of substance and in Kant's doctrine of the categories, these theories are examined.

Of the positions considered, only Aristotle's doctrine of knowledge provides the minimal requisites of immediacy and immutability. It is shown how Aristotle seeks to relate the principles to one another in order to retain connection between the objects of intellectual cognition and the knowing mind. That is, the relation between Aristotle's doctrine of sensation and his doctrine of essences is elucidated to explain how we get from the particularity of sense to the understanding of the universal. Thus, the Aristotelian doctrine of knowledge is defended as providing both requisite principles in a satisfactorily related manner.

On its "negative" side, the study seeks to indicate the inescapable consequences of failure to make provision for the principles of immediacy and of immutability in a theory of knowledge. On its "positive" side, it shows that a matrix of distinctions and categories can be supplied that will enable effective incorporation of both principles within a theory of knowledge. 161 pages. $2.01. Mic 56-858

PERCEPTION, UNDERSTANDING AND STYLE: A STUDY IN THE FOUNDATIONS OF CRITICISM DEVELOPED FROM AN EXAMINATION OF ARTISTIC CREATIVITY AND APPRECIATION

(Publication No. 15,743)

Richard Francis Kuhns, Jr., Ph.D.
Columbia University, 1955

This essay is a study of the conditions for criticism in the plastic and literary arts. As a propaedeutic to a theory of criticism it seeks to make clear the fundamental characteristics of the aesthetic experience and the objects of awareness in that experience. The argument develops from a phenomenological analysis of the creative act and appreciation on the part of the beholder to a system of concepts necessary to any critical theory.

Chapter I prefaces the phenomenological analyses of Chapters II and III with a discussion of perception and its correlative, cognition. A distinction is made between experience, which has both conscious and unconscious elements, and awareness which is the content of consciousness. Criticism has as one of its objectives the fullest development of awareness in the aesthetic situation. That in turn is a necessary condition for understanding, the desired outcome of criticism in the arts.

Chapter II, which presents a phenomenological analysis of the creative act, emphasizes the importance of the medium to the artist, and of synaesthesia as contributory to artistic organization. The medium can be likened to families of variables and functional relationships which are given specific values by the artist in the act of forming the work. Values given to certain variables establish the values for others. These determinations are achieved in part through the awareness of demands made and their possible satisfaction in the growing work.

Regardless of the specific nature of the finished work, the experience of the beholder can be discussed in terms of those general characteristics which belong to all works

of art. Among the characteristics analyzed are frame, intention, affective properties and style. They aid the beholder when he engages in exploration and investigation of the object, and they contribute to the appreciation which follows.

Chapter IV is concerned with methods of investigation in the aesthetic situation, and the development of critical instruments as aids to understanding. While the methods of investigation in aesthetic problems are in some ways like those in the disciplines of the natural sciences, in aesthetic matters we do not seek merely the one actual interpretation of events, but rather seek several possible interpretations of events. Hence the outcome of investigation is not only explanation according to an interpretation which discovers the objects to be coherent, but also the realization of a certain kind of direct awareness.

The last two chapters present a conceptual system for criticism. The focus of attention is upon the categories of form and style. Both form and style have an analytical and a normative use in criticism, for they function in both the analysis and evaluation of works of art. In order to separate the analytical from the normative function of form, a distinction is made between structure and aesthetic form. In regard to style, it is necessary to distinguish style as a summation of artistic techniques which characterize the work of a period, school or individual, from style as subservient to the aesthetic form it makes possible. In the latter sense style can fruitfully be considered a means to expressive organization. Taken together, the two senses of style generate a view of style as the fullest development of a family of artistic variables and functional relationships which, once articulated, provide a ground plan for the creation of works of art. Style, because it controls expressive organization, makes manifest the purposeful selection of relevant artistic elements on the part of the artist, and guides the beholder in his exploration and appreciation of the finished work. The highest achievement of aesthetic form is realized in a developed style. 381 pages. $4.76. Mic 56-859

AN INVESTIGATION INTO THE HUMAN KNOWLEDGE OF THE SINGULAR

(Publication No. 15,675)

Joseph Francis Lanigan, Ph.D.
University of Notre Dame, 1956

This paper offers (1) a case for the existence of a theoretical knowledge of the unique; (2) a phenomenology of this knowledge and of its object; (3) a psychological theory to account for this knowledge; (4) a metaphysical theory.

1. Analysis of such experiences as reflection upon work and worker, participation in celebration, knowledge through historical accounts, and contemplation of poetry indicates the existence of a human knowledge of the singular which is unlike the knowledges of the singular which are recognized and accounted for in the philosophic tradition of Aristotle and Saint Thomas Aquinas. Unlike judgments of art and prudence, this knowledge is a theoretical knowledge; unlike the judgment of the vis cogitativa and the intellect's reflex judgment of the singular, it bears upon the singular not as an individual of a species but as incommunicably singular: that is to say, as unique.

2. The object of this knowledge is (a) unique or nonconceptualizable; (b) caught in sense/imagination experience and inseparable from it; (c) yet intelligible; and (d) grasped in motion or transitive action, (e) viewed as play or expression; and (f) through sympathy penetrated (g) to the center of the person.

3. Accordingly, the knowing operation which is specified by such an object (a) is a knowledge which is a composite act of intellect and of sense/imagination, (b) of such sort that, in a vision of transitive action, the intellect grasps the singular agent-subject as unique (c) by (objective) means of the inclination of direct love (amor amicitiae), (d) which measures a judgment which is not practical, but theoretical, although it derives from practical judgments through the process of diversion: (e) a phenomenon in which what is physically a transitive action is treated as if it were immanent, because it becomes an object of theoretical knowledge, because it is a sign of the agent and the agent wants to know himself, because in willing good for himself, he wills (in direct love) real union with himself as well as (in indirect love: amor concupiscentiae) real union with the good; and (f) this theoretical knowledge of the unique is the real union to which the direct love component in every act of rational love tends. From this last clause, as from a definition, the various forms of the theoretical knowledge of the unique can be derived: fundamentally, they are distinguished one from another according as the concomitant indirect love component is at the stage of rest, of striving, or of inclination. Finally, it can be said that this knowledge extends to all things inasmuch as all the things which are either expressions of persons or persons expressed.

4. This human theoretical knowledge of the unique is to the human theoretical knowledge of the universal as God's scientia visionis is to His scientia simplicis intelligentiae. The theoretical knowledge of the unique and the scientia visionis seem to be analogates of a metaphysical notion of knowledge of that of which the knower is the cause.

218 pages. $2.73. Mic 56-860

AN EMPIRICIST ONTOLOGY: A STUDY IN THE METAPHYSICS OF ALFRED NORTH WHITEHEAD

(Publication No. 15,750)

Frederic Tamler Sommers, Ph.D.
Columbia University, 1955

This study in the metaphysics of Alfred North Whitehead attempts to show how Whitehead employs the empiricist category of "feeling" as central for "ontology." The several elements of Whitehead's thought, his "platonism," his "panpsychism," his teleological theory of actuality, are seen as elaborations of his basic enterprise, viz., the speculative attempt to develop an ontology with feeling as a constitutive factor in the description of substance.

Whitehead's actual entities, construed as centers of experience constituted by feelings are a classical scheme of existence in which every "being" or "existence" has a functional role to play. This functional conception of being is developed from the theory of constitutive feelings. It is shown that the doctrine of constitutive feeling as a way of

construing actuality implies a thoroughgoing functionalism and relativity in ontology. A simplified version of the Whiteheadian scheme of existence is used to exhibit the relations between what Whitehead calls a static vision (i.e., a vision of categories of existence in their static relationship to one another) and a dynamic interpretation. The static vision belongs to the Platonic side of Whitehead's thought. The dynamic interpretation belongs to his functional Aristotelean side. The teleological nature of his "actual occasions" serve to combine the static and dynamic elements in his view of existence.

The study is divided in four parts. Part I is devoted to his functional conception of being. Whitehead's distinctions between immortal, occasional, primordial, and eternal being are shown to correspond to classical distinctions in ontology. Thus actual occasions, the "substances" of Whitehead's metaphysic, are both "real" and "actual." By "real," Whitehead means "eventual" or "temporally extensive," by "actual" he means determinate and limited — something definite and individual. That which is actual is, in terms of his doctrine of substance as constituted by feeling, "subjective." God, is actual and non-temporal. When events pass, they lose their subjectivity, they become potentials in the actualization of further events. This class of entities are real but non-actual; Whitehead calls them "immortal objects."

Whitehead wishes his theory to express the "object-to-subject structure of experience." His doctrine of constitutive feeling, implying the functional conception of being, is shown to agree with the categories of reality and actuality as he uses them to distinguish between subjects and objects. The subjects are "actual," that which is actual having definiteness and individuality. The objects are potentials which are felt by the subjects. Thus immortal objects constitute "real potentiality" while eternal objects constitute "pure potentiality."

Part II applies the Whiteheadian scheme in examining his doctrine of the future, as it is contained in — or felt by — an immediate or present occasion. Whitehead's theory of propositions is treated in this part.

Part III treats his theory of concrescence. How the actual entity emerges and achieves its individuality as a subject-superject is seen to depend upon an ideal subject which is felt by the passing object of the temporal world. God is the teleological savior of the temporal world; "without God there would be nothing new." Whitehead's doctrine of freedom, treated also in Part II is further examined in the context of his theory of concrescence. The various categories of the Whiteheadian scheme are shown as derived from the analysis of substance construed as an experiencing subject and God's role in the process of individualization receives a provisional criticism.

Part IV is an evaluation of Whitehead's empiricist ontology. Whitehead's enterprise of building a "credible universe," a theory rich and concrete in its doctrine of substance so as to avoid the abstractions and errors of past theories is seen to suffer from internal incredibility. The actual entity constructed with the bricks of feeling is perhaps more incredible than anything it may hope to explain. Nevertheless, the enterprise is basically sound; the attempt to construct a doctrine of substance is an ambitious project in a neglected area of modern philosophical construction. 208 pages. $2.60. Mic 56-861

THE WORLD IN WORDS: ON THE RELATION BETWEEN THE MEANING OF TERMS AND THE NATURE OF THINGS; WITH SPECIAL REFERENCE TO AN EVALUATION OF ENGLISH ORDINARY-LANGUAGE PHILOSOPHY

(Publication No. 15,753)

Richard Norman Wisan, Ph.D.
Columbia University, 1955

This study has two connected aims. First, it is an attempt to define the limits and potentialities of English analysis of terms. In particular, the object is to discover the precise force of the objection that the British analysts have mistaken grammar for physics, trying to discover the nature of the world by examining the rules of common usage. Such an evaluation, of course, requires a clear view of the relation between words and things, so the second aim of the dissertation is to develop a theory of meaning which will explain that relation.

The first section contains a study of real definition in Aristotle, Locke, Leibniz, and some contemporary philosophers. The purpose of this preliminary study is to disentangle the tradition of real definition — or at least one important thread in it — from the metaphysics with which it has become associated and which many contemporaries find objectionable. It is important to rehabilitate the notion of factual responsibility in definition, because, if the analysis of meanings is to yield information about the world, there must be some empirical process by which meanings come to contain it. Real definition, considered as part of the practice of inquiry, turns out to be just such a process. The section also contains a chapter on the entirely different enterprise of artificial language construction. It discusses several types and motives for constructions with an eye to contrasting it with real definition and in order to lay the groundwork for some subsequent comparisons with ordinary-language philosophy.

Section Two, which is the heart of the dissertation, is addressed to the main question how and what sort of information can be embedded in terms and how and what kind of analysis can dig it out. Ultimately, this is the question of the relation of ordinary belief to ordinary language, and the first few chapters of the section are devoted to a theory which will explain this relation. According to this theory, which derives from William Empson's The Structure of Complex Words, the application of terms is not in general to be explained by necessary-and-sufficient criteria of classification. A given term applies to importantly different kinds of thing and presupposes a more or less complex system of relations between them. The latter part of the section discusses the extent to which British analysts recognize this fact, its reflection in their analytical practice, and in general its importance for philosophers.

Section Two deals only with the patterns according to which terms may be applied. Section Three distinguishes the application of terms from the functions they perform and instances some British analyses of each. It contains an account of "descriptive meaning" which explicates the sometimes confusing philosophical use of that phrase. Description is a function which involves application-patterns in a peculiarly intimate way, and this account of it indicates that though information can be given in both descriptively and non-descriptively functioning terms, it

is always given through the application-pattern. The study of application-patterns, therefore, can lead to an indirect approach to the nature of the world by way of deeply embedded and generally inexplicit beliefs and attitudes. The study of functions, on the other hand, is a direct sociological study of bits of human behavior which involve the use of language.

The concluding chapter of the dissertation contains a comparison of the present categories of application-pattern and function with the traditional ones, (a) of extension and intension and (b) of syntactics, semantics, and pragmatics. There is also a general discussion of some of the potentialities of British studies of application and function and some observations about the limitations of the present treatment together with its possible extension and adaptation. 253 pages. $3.16. Mic 56-862

PHYSICS

PHYSICS, GENERAL

THE INFRARED ABSORPTION SPECTRUM OF FORMALDEHYDE VAPOR

(Publication No. 15,812)

Henry Hess Blau Jr., Ph.D.
The Ohio State University, 1955

The infrared absorption spectrum of formaldehyde vapor was recorded under high resolution for the spectral region extending from 3 to 10 microns. All six fundamental bands and the $\nu_2 + \nu_5$ combination band were observed.

Formaldehyde is a slightly asymmetric molecule, so that the gross features of the rotational structure of the absorption bands resemble those of a symmetric top to a high degree. The type B bands designated as ν_4, and $\nu_2 + \nu_5$ were partially analyzed by using symmetric top theory. The molecular constants for these bands were determined to be $\nu_0 = 2843.4 \pm 0.2$ cm^{-1}, $a' = 9.200 \pm 0.004$ cm^{-1}, and $1/2(b' + c') = 1.207 \pm 0.001$ cm^{-1} for the ν_4 band, and $\nu_0 = 3003.3 \pm 0.1$ cm^{-1}, $a' = 10.061 \pm 0.002$ cm^{-1}, and $1/2(b' + c') = 1.203 \pm 0.001$ cm^{-1} for the $\nu_2 + \nu_5$ band.

The ν_3 and ν_5 bands are coupled by a rotational resonance interaction, and consequently the rotational structure of the ν_3 band differs from that of a type A band for a slightly asymmetric molecule. Rotational lines originating from transitions where J = K in the upper state are affected but slightly by the resonance interaction. A partial analysis of the band was carried out by using these lines and the symmetric top theory. The constants were determined to be $\nu_0 = 1500.58 \pm 0.08$ cm^{-1}, $1/2(b' + c') = 1.221 \pm 0.001$ cm^{-1} and $1/2(b'' + c'') = 1.217 \pm 0.001$ cm^{-1}.

The ν_2 band, which is a type A band, was analyzed by using the symmetric top theory, and the values $\nu_0 = 1746.07 \pm 0.05$ cm^{-1}, $1/2(b' + c') = 1.208 \pm 0.001$ cm^{-1}, and $1/2(b'' + c'') = 1.216 \pm 0.001$ cm^{-1} were determined. In addition, the series of lines corresponding to the transitions $\triangle J = \pm 1$, $\triangle K = 0$, $K = 1$ were identified by using the asymmetric formulation.

The ν_5 and ν_6 bands, which are type B and type C respectively, are strongly coupled by a rotational resonance interaction. A complete analysis of the rotational structure of these bands was carried out, and the constants were determined to be $\nu_0 = 1247.44 \pm 0.08$ cm^{-1} and 1163.49 ± 0.08 cm^{-1} for ν_5 and ν_6 respectively, $\tau = 0.541 \pm 0.001$, $\kappa' = -0.962 \pm 0.002$, $a' = 9.394 \pm 0.003$ cm^{-1}, $b' = 1.290 \pm 0.002$ cm^{-1}, and $c' = 1.133 \pm 0.002$ cm^{-1}. In addition, the previous assignment by Nielsen of the low frequency band as ν_6 was verified by analysis of the rotational structure of the band. 123 pages. $1.54. Mic 56-863

COMMUNICATION ASPECTS OF V.H.F. AURORAL REFLECTIONS

(Publication No. 15,011)

Rolf Buchanan Dyce, Ph.D.
Cornell University, 1955

Experiments on frequencies around 50 Mc/s in northeastern United States and northern Alaska show the following: 1) The occurrence of auroral reflections have distinct diurnal, seasonal, and solar activity variations, 2) the reflection condition is that the transmitted and reflected rays should be nearly perpendicular to the magnetic field at the position of the aurora, and 3) the fraction of incident energy reflected is on the order of 10^{-4}. The effects of auroral reflections on V.H.F. communication circuits are discussed. 128 pages. $1.60. Mic 56-864

NUCLEAR QUADRUPOLE INTERACTIONS IN TWO TUTTON'S SALTS

(Publication No. 15,707)

Robert Fredrick Kiddle, Ph.D.
University of Washington, 1955

This paper reports results of nuclear induction experiments on two isomorphic single crystals of Tutton's salts $\left(\begin{smallmatrix}Rb_2\\Cs_2\end{smallmatrix}\right)Mg(SO_4)_2 \cdot 6H_2O$ belonging to crystal class $P2_1/a$. The splitting of the nuclear magnetic resonance spectra of Rb^{87} and Cs^{133} observed in these experiments due to nuclear electric quadrupole interactions are analyzed using perturbation theory. Analysis of the data yields a quadrupole coupling constant for Rb^{87} as $\frac{|eQq|}{h} = 3141 \pm 35$ Kc/s and the

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asymmetry of the field gradient at the nuclear site is

$$\eta = \frac{\phi xx - \phi yy}{\phi zz} = .472 \pm 01.$$

The principal axis of the field gradient is directly toward the nearest sulfate ion but no correlation of asymmetry and near neighbor locations is observed.

Comparison of the symmetry axis rotation spectra of the Cs with coefficients derived from the Rb^{87} analysis is used to obtain an estimate of the Cs quadrupole moment. From the known moment of Rb^{87} and assuming a similar electric environment in the two cases an upper limit of .02 barns is placed on the Cs quadrupole moment. The complexity of the Cs spectra for other rotations precluded a more complete comparison between the electric field gradient tensors in the different crystals.

40 pages. $1.00. Mic 56-865

A CALCULATION OF THE SPECTRAL ISOTOPE SHIFT IN NEUTRAL CARBON

(Publication No. 15,986)

James P. Nicklas, Ph.D.
The University of Buffalo, 1956

A calculation has been made of the isotope shift of the spectral line (λ=2478.5A) arising from the transition $2p^2\ ^1S$ - $2p\ 3s\ ^1P$ of neutral carbon. As a preliminary step in the calculation, approximate wave functions of both the Hartree and Hartree-Fock types were computed for the $2p\ 3s\ ^1P$ term of carbon. The Hartree functions were calculated by numerical methods on a desk calculator and six figures after the decimal were carried in all steps. The Hartree-Fock functions were computed on an International Business Machines card programmed calculator using a floating decimal system carrying eight significant figures. Hartree-Fock functions for the $2p^2\ ^1S$ term were also computed to higher accuracy than has previously been reported. The tabulated values of all three sets of wave functions are given.

The isotope shift calculation was based on the Hughes-Eckart theory which treats the effect of nuclear motion on the energy levels of an atom. The specific shift of the spectral line (λ=2478.5A) of C^{13} relative to C^{12} has been reported by other investigators experimentally as -0.297 $\pm$0.002 cm^{-1}. The values computed with Hartree and Hartree-Fock functions are -0.317 cm^{-1} and -0.323 cm^{-1}, respectively. Contrary to expectations the Hartree-Fock functions do not give a better value than the Hartree functions. The error in the numerical calculation is not over 0.005 cm^{-1} so that the computed values do not agree with the observed value of the shift to within the experimental error. It is demonstrated that the mixing of these wave functions is not advisable; e.g., the use of Hartree functions for the $2p\ 3s\ ^1P$ term and Hartree-Fock functions for the $2p^2\ ^1S$ term gives a transition specific shift of -0.392 cm^{-1}. The calculation of isotope shift by means other than the use of energy eigenfunctions may yield better results; the use of momentum wave functions is suggested as one possibility.

The energy of the $2p\ 3s\ ^1P$ term was computed with Hartree-Fock functions as -37.42 atomic units. This value is 0.27 atomic units (0.7%) above the observed energy of the term. 108 pages. $1.35. Mic 56-866

THE PREPARATION OF HIGH-PURITY GERMANIUM

(Publication No. 15,410)

William Edwin Taylor, Ph.D.
Purdue University, 1950

Major Professor: J. L. Bray

By a double-fusion process and selective cutting of ingots, single crystal germanium samples of higher purity than any previously reported have been prepared. In the most nearly pure samples the room-temperature resistivity is about 35 ohm-centimeter, and the Hall constant in the exhaustion range is over 100,000 $cm.^3$/coul., corresponding to approximately 8×10^{13} effective impurities per cubic centimeter. The theoretical resistivity of "pure" germanium is 65 ohm-centimeter. Such pure germanium would have approximately 8×10^{13} intrinsic carriers at room temperature. The direction of growth of germanium crystals forming from the melt has been found to be the [110] direction.

The effects of quenching germanium from elevated temperatures have been correlated with the introduction of an equilibrium number of lattice defects which are retained by the quenching process. The equilibrium number of defects at 700°C. is about 1×10^{16} per cc., and at 500°C. is approximately 1.5×10^{13} per cc. The equilibrium number of defects can be represented by an exponential law in which the number of defects is determined by their energy of formation. This energy is temperature dependent, having the form

$$W = 42{,}000 \text{ cal/mol} - 1.2 \text{ cal/mol/}^0K\ .$$

Electrical barriers having a potential height of 0.25 eV. have been found at grain boundaries in N type germanium. These barriers can be explained by the existence of localized states which become charged as a voltage is applied to the barrier. The number of localized states has been found to be of the order of magnitude of 10^{12} per square centimeter. 98 pages. $1.23. Mic 56-867

A CALCULATION OF THE SPECTRAL ISOTOPE SHIFT IN NEUTRAL OXYGEN

(Publication No. 15,987)

Charles E. Treanor, Ph.D.
The University of Buffalo, 1956

Isotope shifts in levels of the first and second excited configurations of oxygen were calculated, using Hartree one-electron wave functions computed for $1s^22s^22p^33s$ and $1s^22s^22p^33p$, and using Hartree-Fock wave functions computed for $2p^33s\ ^5S$ and $2p^33p\ ^5P$. The suitability of the wave functions for this type of calculation was checked with recent experiments in nine spectral lines of neutral oxygen. Use of the Hartree functions resulted in discrepancies between calculated and observed shifts of from -0.09 cm^{-1} to +0.09 cm^{-1}. Calculations employing the Hartree-Fock functions gave a result of 0.0184 cm^{-1} for the specific shift in 7772($3s\ ^5S$--$3p\ ^5P$), in good agreement with the experimental value of 0.0165 $\pm$ 0.0015 cm^{-1}. Use of these Hartree-Fock functions for calculation of shifts in other levels of the same configurations gave results which agreed

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with experiment for six of the other eight transitions. One of the remaining two lines is thought to be incorrectly classified.

The energy of the $2p^3 3s\ ^5S$ state was calculated, using the Hartree-Fock wave functions. The calculated value was -74.47 atomic units. The experimental value of this energy is -74.98 atomic units.

115 pages. $1.44. Mic 56-868

THE INFRARED SPECTRUM AND STRUCTURE OF CRYSTALLINE FERROCENE

(Publication No. 15,911)

William Kenneth Winter, Ph.D.
Kansas State College, 1956

The purpose of this work was to obtain and explain the infrared spectrum of single crystals of ferrocene (bis-cyclopentadienyl iron II). To facilitate the assignment of infrared bands, a normal coordinate analysis was performed on the molecule, using the multiple origin method developed in recent years at The Ohio State University.

The infrared spectrum of ferrocene vapor at about 130° C. was first obtained. Of the ten infrared active fundamentals predicted for this molecule under D_{5d} symmetry, nine were observed in the vapor spectrum and one, the ring-Fe-ring bending mode, was assigned a range of frequencies on the basis of the normal coordinate treatment.

Ferrocene crystallizes in a monoclinic lattice having the symmetry of space group C_{2h}^5, with two molecules per unit cell. Relatively large single crystals of ferrocene were grown from benzene solution. Two types of crystals were obtained, both being thin flat plates and both bounded by the same sets of crystal planes. The difference lay in which crystal plane was enlarged, being in one case the (001) plane and in the other case the (110) plane. Infrared spectra of both types of crystals were obtained using plane polarized radiation of two orientations. For both types of crystals the radiation was incident normal to the large face. The spectra, as obtained, are presented.

Selection rules for the crystal indicate that all vibrations which are antisymmetric with respect to the center of symmetry of the molecule may be infrared active. Of the eighteen such fundamentals, sixteen are observed in the crystal spectra. The two modes not observed are the ring-Fe-ring bending mode and the internal rotational vibration. The remainder of the bands appearing in the crystal spectra have been assigned as overtones or combination frequencies. Several bands which were otherwise difficult to assign were adequately accounted for as combinations involving the ring-Fe-ring bending mode if that mode was assigned a frequency of 246 cm^{-1}.

The plausability was investigated of assigning the complex band in the vicinity of 1700 cm^{-1} as a combination frequency involving hindered internal rotation. Such an assignment was found to be capable of accounting for most of the features of the band, although it is subject to some objections.

The effects of using polarized radiation were considered only for the (001) crystal, the other crystal being so oriented as to make interpretations impracticable. In general the polarization effects were small. Site group splitting of about 10 cm^{-1} was observed for the two degenerate out-of-plane CH bending modes. Factor group splitting may possibly have been observed in several bands, although it was so slight (about 2 cm^{-1}) as to be uncertain.

132 pages. $1.65. Mic 56-869

PHYSICS, ELECTRONICS AND ELECTRICITY

LUMINESCENCE FROM SODIUM CHLORIDE

(Publication No. 14,971)

William Edward Spicer, Jr., Ph.D.
University of Missouri, 1955

Supervisor: Dr. Eugene B. Hensley

The luminescence from single crystals of NaCl has been studied in the range from 2.07 ev (600 mu) to 5.16 ev (240 mu). Both the intensity and spectral distribution of the luminescence produced by continuous x-ray irradiation was found to depend on the previous history of the crystal. Untreated crystals exhibited luminescence bands at 2.25 ev (550 mu), 3.1 ev (400 mu), and 5.0 ev (250 mu). Heating a crystal in air to temperatures above about 400°C produced strong new bands at 2.45 ev (505 mu) and 3.51 ev (352 mu) and increased the intensity of the 5.0 ev band. The effect of heating was the same whether the sample was heated in air or vacuum; however, the new bands did not appear if it was heated in the presence of sodium vapor. The intensity of the new bands decreased with distance into the crystal.

The effect of heat treatment could be altered by prolonged x-ray irradiation. After such treatment, the 2.45 and 3.51 ev bands almost completely disappeared; the 2.25 ev band reappeared; and a new band at 2.9 ev appeared. Prolonged x-ray irradiation had no such effect on crystals which had not been heated.

The luminescence produced by irradiating the x-ray colored crystals with light absorbed in the F band was studied. In the heated crystals, the bands observed under continuous x-ray irradiation at 2.45 and 3.51 ev could also be produced in this manner. In the unheated crystals, no luminescence was observed.

On the basis of this evidence, it is suggested that the heat treatment produced sodium ion vacancies at the surface of the crystal from which they diffused into the crystal. It is further suggested that the 3.51 ev luminescence occurred when a conduction band electron recombined with a hole at a V_2 center, and that the 2.45 ev luminescence resulted from the recombination of a conduction band electron with a hole at a V_4 center.

An afterglow was observed following x-ray irradiation. After this afterglow had decayed away, it could be revived by irradiation with light absorbed in the F band. The afterglow seemed to be due to the thermal release of electrons from F′ centers and from a center which had an absorption peak at 1.25 ev (1000 mu). 118 pages. $1.48. Mic 56-870

MAGNETIZATION AND REVERSIBLE SUSCEPTIBILITY IN SINGLE CRYSTALS OF NICKEL

(Publication No. 11,062)

William Mooney Woodward, Ph.D.
Princeton University, 1943

Abstract not available. 64 pages. $1.00. Mic 56-871

PHYSICS, NUCLEAR

AN ATTEMPT TO OBSERVE THE LYMAN α LINE OF THE POSITRONIUM SPECTRUM

(Publication No. 15,691)

Robert Leslie Brock, Ph.D.
University of Washington, 1955

An attempt has been made to observe the predicted Lyman α line (2430A) of the positronium atomic spectrum. The line was not detected, and the possible reasons, and implications, are discussed. On the basis of reasonable assumptions, it is estimated that the expected intensity exceeded the detectable minimum by a factor between 6 and 60.

Various sources of positronium were used. The sources were designed on the basis of assumptions that either thermalized positrons or epithermal positronium atoms diffuse readily through solids, and that they escape from the surface of a solid as positronium atoms, of which some are in excited states. Positrons were supplied by a Cu^{61} source of ~ 90 millicuries positron activity. Sources employing the surface of gold, and the surface of polystyrene, were examined spectroscopically. Also fused quartz in which positrons were stopping was examined to determine if any radiative effects due to positronium inside the quartz could be observed. The fluorescence of the polystyrene and quartz was found to be prohibitively intense. Appreciable visible, or ultraviolet, radiation was also emitted by the gold surface source, and it was presumed to be cathodoluminescence of the gold. It was not definitely determined whether the luminescence spectrum of gold contained far-ultraviolet components which would prohibit a more sensitive observation of the positronium Lyman α line. Suggestions are made which should provide perhaps a ten-fold improvement of sensitivity of the experiment, provided the far-ultraviolet luminescence of the source materials, and Cerenkov radiation, is negligible.

A large-aperture Rocksalt prism spectrometer, with aluminized paraboloidal mirrors as collimator and objective, and a refrigerated photomultiplier detector, was designed and constructed especially for the experiment. Details of the design and construction of the apparatus are presented. Characteristics of the refrigerated photomultiplier are also described, and new aspects of the application of such detectors are illustrated. It is suggested that a spectrometer of this type might offer unique possibilities for the spectrographic study of weakly luminescent solids excited by intense long-lived radioactivity.

197 pages. $2.46. Mic 56-872

A CLOUD CHAMBER STUDY OF THE SECONDARY PARTICLES FROM LOCALLY PRODUCED PENETRATING SHOWERS

(Publication No. 15,723)

Norman Frederick Harmon, Ph.D.
Washington University, 1955

Chairman: Professor Robert D. Sard

The exponent in the inverse power law momentum spectrum of the high energy secondaries from penetrating showers is found to lie between 2 and 3, consistent with the results of other workers. The noise scattering, determined with the momentum spectrum, is found to correspond to a "maximum detectable momentum" greater than 2 Bev/c.

Several interesting heavy unstable particle decays have been found. A charged γ-meson decay in flight into three charged π-mesons was observed. The calculated mass of the primary was (1000 $\pm$ 630) Mev. This particle lived (3.76 $\pm$ 0.75) x 10^{-10} sec., in its rest frame, in the illuminated volume of the chamber. An example of a charged V-decay in flight giving rise to a charged L-meson and a π^0-meson decaying in its normal mode was also observed. From the upper and lower momentum limits on the charged secondary and the energy of one of the photons from the decay of the π^0, as estimated from the observed cascade shower, a Q (π,π^0) value of 300 Mev is calculated. Within the experimental errors this value is consistent with the presently accepted Q of 219 $\pm$ 5 Mev.

Two unusual V^0-decays were found. In one case, one secondary suffers a large angle scattering in one of the plates. From momentum and ionization this particle is identified as a π-meson. The other visible product is associated with a cascade shower. The event is consistent with a θ^0-decay into two π-mesons one of which undergoes charge exchange. It is also consistent with the possible decay, $V^0 \longrightarrow \pi + e\ (+?^0)$, the minimum Q value being 223 Mev.

In the second V^0-decay, one of the secondaries suffers a deflection of $(11 \pm 4)^0$ in the gas of the chamber. It is quite unlikely that this is a nuclear scattering. Assuming the deflection to be due to a decay in flight, this is the first reported event in which a neutral V-particle decays into a charged V-particle. With the information available the V^0-particle may be either a K-meson or a hyperon.

Two events were observed whose interpretation are of some interest. In one, four cascade showers of 4 Bev total energy are found to be associated with the disappearance of a fast charged particle in a plate. All of the showers occur in plates below that in which the incident particle stops. There are no ionizing links. Because of the high energies involved this event may be interpreted as the annihilation in flight of a baryon with a nucleon into two π^0-mesons. The other event may be interpreted as the decay of a neutral hyperon into a neutron and a neutral π-meson. The Q value for the process is 117 $\pm$ 70 Mev.

169 pages. $2.11. Mic 56-873

A CLOUD CHAMBER STUDY OF THE ELECTROMAGNETIC PROCESSES OF THE SEA LEVEL COSMIC RAY PARTICLES AND THE MOMENTUM DISTRIBUTION OF THE PRIMARIES OF COUNTER-SELECTED SHOWERS

(Publication No. 15,704)

Erle Howell, Jr., Ph.D.
University of Washington, 1955

A cloud chamber with a magnetic field has been used to measure to about 50 Bev/c the momentum distribution of the primaries of counter selected secondary electron showers in lead and aluminum. The results for secondary energies greater than 1 Bev are consistent with the assumptions that (a) the primaries are all mu-mesons, (b) the probability for electro-magnetic interactions are given by the theoretical cross sections for meson-electron collision, bremsstrahlung, and direct pair production by muons, and (c) the sea level momentum distribution of penetrating particles may be approximated by a power law p^{-s} with $s = 2.1$ for $10 < p < 100$ Bev/c and $s = 3$ for $p > 100$ Bev/c. $s = 2.1$ for $p > 100$ Bev/c and $s = 3$ for $p > 20$ Bev/c are not consistent with the observations. The effect of counter selection is considered and evidence for the relative importance of the three energy loss mechanisms is discussed. 141 pages. $1.76. Mic 56-874

COINCIDENCE AND ANGULAR CORRELATION MEASUREMENTS ON THE GAMMA-RAYS FROM COBALT-56 AND VANADIUM-48

(Publication No. 15,725)

John Paul Hurley, Ph.D.
Washington University, 1955

Chairman: Phillip S. Jastram

This study deals with the decay schemes of Cobalt-56 and Vanadium-48. Such a study involves the determination of (A) the energies of the gamma-rays, (B) which gamma-rays are in coincidence, and (C) the angular correlations of the cascaded gamma-rays. Displayed prominently in the spectrum of Cobalt-56 are gamma-rays of the following energies: 0.511 Mev (annihilation radiation), 0.845 Mev, 1.238 Mev, 1.75 Mev, 2.02 Mev, 2.18 Mev, 2.60 Mev, and 3.25 Mev. Results of coincidence measurements are summarized in the following table: Gamma-rays listed are those which are identifiable in the scintillation counter spectrum.

	0.511	0.845	1.026	1.238	1.50	1.75	2.02	2.18	2.60	3.25
0.511		yes	no	yes	no	no	no	no	no	no
0.845	yes		yes	yes	yes	yes	yes	yes	yes	no
1.238	yes	yes	no		no	yes	no	no	no	no

Angular correlation measurements on the triply-cascaded gamma-rays of 0.845 Mev, 1.238 Mev, and 1.75 Mev called for spin assignments of 5, 4, 2, and 0 for the energy levels in Iron-56 involved in the triple cascade. An analysis of a possible mixture of the radiations in the first transition shows that the transition is predominately dipole with a small quadrupole admixture of approximately seven percent.

Measurements on the gamma-ray spectrum of Vanadium-48 confirmed the energies to be 0.511 Mev (annihilation radiation), 0.99 Mev, 1.32 Mev, and 2.22 Mev. Coincidence data show that the 1.32 Mev and 2.22 Mev gamma-rays are both in coincidence with the 0.99 Mev transition. Angular correlation measurements on the 1.32 Mev - 0.99 Mev transitions confirmed spin assignments of 4, 2, and 0 for the Titanium-48 energy levels involved in the cascade. Measurements on the 2.22 Mev - 0.99 Mev transitions called for spin assignments of 2, 2 and 0 for the energy levels involved in the cascade. An analysis of a possible mixture of the radiations in the 2.22 Mev transition shows that the transition is predominately quadrupole with a small dipole admixture of approximately three percent. 107 pages. $1.34. Mic 56-875

NUCLEAR MAGNETIC RELAXATION IN 1-2, DICHLOROETHANE

(Publication No. 15,726)

Solomon Leon Linder, Ph.D.
Washington University, 1955

Chairman: George E. Pake

Analysis of nuclear magnetic relaxation times in solid and liquid 1-2, dichloroethane yields the following information:

1. The mechanism causing thermal relaxation in the solid is probably a partial rotation of the molecule about the molecular axis (which is approximately the C-C axis) against a potential barrier of about 1.5 kilocalories per mole.
2. It is likely that the narrowing of the resonance line is a result of the completion of this partial motion.
3. In the liquid, a new motion has set in, characterized by a lower activation energy (roughly 0.6 kcal/mole). This motion may be end-over-end tumbling.

The spin-lattice relaxation time ("thermal" relaxation time) in the solid ranges between 1 and 20 seconds, and its length permits its measurement by a method which is slightly different from the conventional technique. This technique utilizes the fact that, immediately upon application of the radiofrequency field, the magnetization of the sample decays with a time which can be related to the thermal relaxation time and to the strength of the radiofrequency field. The measurement is a direct measurement of a characteristic time of the sample, and is therefore more reliable than the conventional indirect measurement.

The technique also enables one to calibrate the radiofrequency field more easily. 66 pages. $1.00. Mic 56-876

A PHYSIOLOGICAL STUDY OF 9 ALPHA HALOGENATED STEROIDS ON ADRENALECTOMIZED DOGS

(Publication No. 13,663)

Carleton Harold Baker, Ph.D.
Princeton University, 1955

Adult, mongrel dogs which had been adrenalectomized for periods ranging from 2-5 years and which varied in weight from 9.9 to 19.5 kg. were used for testing the physiological activity of the 9 alpha halogenated derivatives of several of the better known adrenal steroids and two progesterone compounds.

The tests involved bioassay of the following compounds: 9α-chlorohydrocortisone acetate, 9α-fluorohydrocortisone acetate, 9α-fluorocorticosterone acetate and the 9 alpha-halo derivatives of progesterone, viz. fluoro-11β-hydroxyprogesterone and fluoro-11β,17α-dihydroxyprogesterone.

All of these halogenated steroids proved to be highly efficacious for maintaining normal health and vigor in long-term adrenalectomized dogs. When administered parentally, the minimum maintenance doses (M.M.D.) of the compounds sufficient to keep the animals healthy and strong with normal arterial pressures and serum electrolyte patterns were as follows: Chlolo-F-acetate, 55-110 μg/dog/day; fluoro-F-acetate, 27.5 μg/dog/day; fluorocorticosterone acetate, 6.85 μg/dog/day for three animals and 13.75 μg/dog/day for one animal. The 9 alpha-halo progesterones were less active since the M.M.D. for fluoro-11β-hydroxyprogesterone was 150 μg/dog/day and the fluoro-11β,17α-dihydroxyprogesterone was 300 μg/dog/day.

Also fluorohydrocortisone was studied for its overdosage effects in two dogs. A marked polydipsia and polyuria were noted with an increase in the urine electrolyte excretion when 3 mg/kg/day were administered orally. Tetany-like symptoms were observed in both animals and edema was noted in one.

Comparison of the potency of the halogenated derivatives with their unmodified parent steroids showed that the substitution of halogen for the hydrogen atom at the 9 alpha position had increased their potency in so far as their mineralocorticoid activity is concerned, several hundred times. One of the compounds, 9 alpha-fluorocorticosterone proved to be as potent as aldosterone for life maintenance.

The reason for the great increase in potency on the steroids which is induced by the substitution of the halogen atom at the 9 alpha position, remains unknown. However, it seems not improbable that these man-made modifications of the natural compounds will eventually replace cortisone, hydrocortisone and desoxycorticosterone for clinical and experimental use. 100 pages. $1.25. Mic 56-877

THE THYROID SECRETION RATE OF DOMESTIC FOWL AS DETERMINED BY GOITROGEN AND RADIOIODINE TECHNIQUES

(Publication No. 14,955)

Harold Victor Biellier, Ph.D.
University of Missouri, 1955

Supervisor: C. W. Turner

An investigation has been conducted in order to gain information as to the rate of thyroid hormone secretion in several species of domestic fowl. The estimated daily thyroxine secretion rates of growing birds as determined by the goitrogen technique (determining the amount of thyroxine injected daily required to correct the goitrogenicity of feeding 0.1 per cent thiouracil) were as follows: male White Pekin ducklings ranged from 2.85 micrograms of D,L-thyroxine per 100 grams body weight at three weeks of age to 3.18 micrograms of D,L-thyroxine per 100 grams body weight at twelve weeks of age, and the females from 2.67 to 3.39 micrograms of D,L-thyroxine per 100 grams body weight at comparable ages; male Beltsville Small White turkey poults were 2.31, 1.93, and 1.52 micrograms of D,L-thyroxine per 100 grams body weight at three, six, and ten weeks of age respectively, and the females were 2.55, 2.30, and 1.67 micrograms of D,L-thyroxine per 100 grams body weight at comparable ages; and male Delaware X New Hampshire crossbred chicks were 1.55, 1.41, and 0.92 micrograms of L-thyroxine per 100 grams body weight at three, seven, and nine weeks of age respectively, and the females were 1.64, 1.49, and 1.00 micrograms of L-thyroxine per 100 grams body weight at comparable ages.

A method of determining the thyroxine secretion rate of an individual bird was described and used to obtain data on turkey poults and chicks. The technique consisted of intraperitoneal administration of ten microcuries of I^{131} per 100 grams body weight to birds to serve as a tracer of thyroid hormone release into the circulation. Thyroid activity was measured by the radioactivity of serial blood samples as influenced by exogenous thyroxine administered on a body weight basis. A progressively decreasing dosage range of thyroxine that began slightly above the physiological level was injected subcutaneously at either twelve or twenty-four hour time intervals. The initial doses of thyroxine inhibited the release of labeled thyroid hormone and thereby caused the blood radioactivity to decline. When doses of thyroxine less than the thyroxine secretion rate of the bird were injected, the thyroid activity was resumed as shown by increasing blood radioactivity. The mean value of the dose of thyroxine that inhibited thyroidal radioiodine release and the dose that permitted thyroidal radioiodine release was taken as the inhibitory dose of exogenous thyroxine equal to the thyroxine secretion rate of the bird.

The estimated daily L-thyroxine secretion rated per 100 grams body weight as determined by the radioiodine whole blood technique were as follows: male Beltsville

Small White turkey poults were 0.9 micrograms at three weeks of age and 0.55 micrograms at fifteen weeks of age, and the females were 1.1 micrograms and 0.70 micrograms at comparable ages; male Delaware X New Hampshire chicks were 1.30 micrograms at three weeks and 0.90 micrograms at eight weeks of age, and the females were 1.20 micrograms and 1.00 micrograms at comparable ages; and a range of 0.80 to 1.20 micrograms for twenty-four fifteen-week-old Single Comb White Leghorn cockerels.

The indicated amount of thyroprotein necessary in the ration to equal the thyroid hormone secretion of three-week-old crossbred chicks was between 0.00441 and 0.00661 per cent (two to three grams of thyroprotein per 100 pounds of ration). Levels of 0.0022 to 0.0033 per cent (1.0 to 1.5 grams of thyroprotein per 100 pounds of ration) fed in the ration were sufficient to equal the ten-week-old chick's thyroid secretion rate.

246 pages. $3.08. Mic 56-878

THE INFLUENCE OF CLIMATIC FACTORS ON THYROID ACTIVITY AND RADIOIODIDE METABOLISM OF DAIRY CATTLE

(Publication No. 14,956)

Clifton Robert Blincoe, Ph.D.
University of Missouri, 1955

Supervisor: Samuel Brody

Data are presented on the effect of carefully controlled climatic factors on the thyroid activity and iodide metabolism of Jersey, Holstein, Brown Swiss, and Brahman (Zebu) cows along with a review of the literature and detailed discussion of techniques. The conversion ratio (ratio of blood plasma thyroxine-like I^{131} to total I^{131}), thyroid uptake of I^{131}, and the rate constants for thyroid uptake of I^{131} and hormone release were used as parameters of thyroid activity. The rate constants for plasma clearance, thyroid uptake, excretion, and transcapillary diffusion of radioiodide were taken as indices of iodide metabolism. The excretion of I^{131} in milk and urine was also measured.

The comfort zone for cattle has been defined as 32° to 60° F. (0° to 16° C.). Increasing constant ambient temperature above the comfort zone to 95° F. (35° C.) decreases the thyroid activity 30 to 65% in the four breeds of cows studied. Holstein cows showed the greatest decrease and the Brahman the least. Decreasing constant ambient temperature below the comfort zone to 17° F. (-8° C.) increased the thyroid activity in Jersey and Brahman cows 35 to 60% but did not increase the thyroid activity of Holstein and Brown Swiss cows.

A diurnal temperature cycle of 70° to 100° F. (21° to 38° C.) decreased the thyroid activity 40% below its value during a 40° to 70° F. cycle and a temperature cycle of 10° to 40° F. (-10° to 4° C.) increased the thyroid activity by about 10%.

Air velocity in the range 0.5 to 10 miles per hour (0.8 to 17 Km. per hr.) had no effect on the thyroid activity of Holstein and Brown Swiss cows in the temperature range 17° to 80° F. (-8° to 27° C.), or in Jersey and Brahman cows in the temperature range 17° to 95° F. (-8° to 35° C.).

The addition of 180 Btu./ft.^{2}/hr. (488 Kcal./m.^{2}/hr.) radiant energy (light) reduced the thyroid activity of Jersey cows at 70° and 80° F. (21° and 27° C.), and Holstein cows at 80° F. air temperature.

Overall iodide metabolism as reflected by the rate of clearance of plasma iodide was unaffected by ambient temperature, air velocity, or radiation level. As heat stress increased, the rate of clearance of plasma iodide by the thyroid decreased and the excretion rate increased. The proportion of I^{131} excreted in milk decreased with increasing heat stress and that in urine increased. The rate constant for transcapillary diffusion of I^{131} was not altered by the conditions studied.

The rate constant for thyroid hormone release is suggested as the best single index of thyroid activity in dairy cattle. 109 pages. $1.36. Mic 56-879

GROWTH RATE OF CALVES AND IN VITRO METABOLISM OF LIVER AND THYMUS TISSUE AS AFFECTED BY ANTIBIOTICS

(Publication No. 14,957)

John McKinney Buckalew, Ph.D.
University of Missouri, 1955

Supervisor: C. P. Merilan

In preliminary growth studies, Holstein heifer calves receiving 80 mg. of aureomycin daily gained an average of 24% more weight from birth to eight weeks of age than their controls. This difference was significant at p.05. Calves receiving 80 mg. of terramycin daily gained an average of 9% more weight than the controls, a difference which was not statistically significant. No differences in height at the withers or incidence of scours were noted which could be attributed to antibiotics.

The effect of aureomycin on the in vitro metabolism of bovine liver and thymus tissue was studied manometrically. Low levels of aureomycin appeared to have an inhibitory effect on the anaerobic metabolism of liver tissue while increasing concentrations of aureomycin resulted in a stimulation of anaerobic activity. In the concentrations employed, aureomycin had no effect on the oxygen uptake of liver slices under aerobic conditions.

Studies on the effect of aureomycin on in vitro metabolism of the thymus indicated that the antibiotic did not significantly alter either the aerobic or the anaerobic metabolic rate of thymus slices.

During the experiment, a number of liver and thymus slices were stored in a modified Tyrode's solution prior to making the manometric determinations. Metabolic activity of this stored tissue indicates that liver and thymus tissue can be stored for at least two days without materially imparing its value for this type of in vitro metabolism study. 62 pages. $1.00. Mic 56-880

STUDIES ON THE METABOLISM OF ETHYLENE GLYCOL IN THE FAT BODY AND MALPIGHIAN TUBULES OF INSECTS

(Publication No. 15,009)

Stuart Edward Dixon, Ph.D.
Cornell University, 1955

Interest in the metabolism of ethylene glycol developed from the observation of Patton et al. that ethylene glycol impaired the excretory function of insects.

The fate of ethylene glycol in vertebrates is not a settled question. There is evidence, however, that ethylene glycol is metabolized partly to oxalate via glycolic acid with the presumed production of aldehyde intermediates, probably glycolic aldehyde and glyoxylic acid.

This study was undertaken to determine its fate in the insect.

Quantitative data here presented indicate that ethylene glycol is not metabolized to oxalate in vivo in the American roach.

Mortality studies on ethylene glycol and its degradation products in the insect suggest that the compounds in question can be arranged in the following order of increasing toxicity to the American roach: ethylene glycol, glycolic aldehyde, glycolic acid, glyoxylic acid and oxalic acid.

Histopathological effects of ethylene glycol and its intermediates were difficult to assess due to the abundance of uric acid, urates and other crystalline deposits in fat cells.

In vitro experiments using homogenates of the fat body and malpighian tubules of the meal worm, Tenebrio molitor, with tetrazolium blue as the artificial hydrogen acceptor, indicate that there is both an alcohol and an aldehyde dehydrogenase present in these tissues. Homogenates are able to metabolize ethylene glycol with the production of aldehyde and able also to metabolize glycolic aldehyde. The product of glycolic aldehyde metabolism was not determined.

Ethylene glycol stimulates endogenous respiration (increased reduction of tetrazolium blue) of fat body homogenates, whereas glycolic aldehyde depresses the oxidase systems. The simplest explanation of the cause of impairment to the excretory system of roaches, after the injection of ethylene glycol, seems to be that glycolic aldehyde and not ethylene glycol is the causal agent.

To explain the inhibiting effect of glycolic aldehyde on oxidase systems is another question. Glycolic aldehyde could bring about a competition for co-factors necessary to the enzyme responsible for its metabolism and thus decrease oxidase activity generally. This suggestion has merit because after the injection of ethylene glycol, riboflavin, which is normally stored in the malpighian tubules, diminishes in quantity.

There is also the possibility that glycolic aldehyde is bringing about a blockage due to its aldehydic reactant group. This blockage could affect glutathione by reacting with it in a manner similar to that of methyl glyoxal or it could react with the sulfhydryl groups of tissue proteins generally. This latter suggestion has merit particularly if the metabolism of glycolic aldehyde is slow and toxic symptoms become apparent.

The proposed products of the metabolism of ethylene glycol are discussed in relation to other biochemical mechanisms. 47 pages. $1.00. Mic 56-881

AN EVALUATION OF VARIOUS AVENUES AVAILABLE FOR VISUALIZATION OF THE LIVER WITH X-RAYS

(Publication No. 15,238)

James Lester Matthews, Ph.D.
University of Illinois, 1955

The liver is one of the few structures in the body for which a safe and dependable roentgen contrast agent has not been produced. Colloidal thorium dioxide has been used but has been criticized because of its permanent nature. Production of a liver contrast agent was attempted and three types of compounds were primarily investigated.

Halogenated oleic and linoleic acids were administered orally to dogs and rats and radiographs were made at 6 hour intervals for a period of 36 hours to determine the practicality of this approach to hepatography. No opacity of the liver was noted although the fatty acids appeared to be absorbed. The apparent digestibility of the compounds was found to be high, but their absorption route was found to be the lymphatic system, permitting removal of the fatty acids by the fat depots before they could accumulate in the liver. Thus there appears to be no physiological basis for oral administration of fatty acids in hepatography.

Suspensions of N-propyl 3-5 di-iodo-4-N-pyridone-acetate (propyliodone) and a peptide derivative N-tyrosine 3-5 di-iodo-4-N-pyridone-acetate did not produce liver opacity when administered intravenously in rats and rabbits. These compounds were hydrolyzed and excreted in the urine faster than they were phagocytized by the reticuloendothelial cells. The successful use of a particulate, metabolizable contrast medium does not seem likely due to the rapid breakdown of particles small enough to be injected.

Halogenated vitamin A was administered orally, parenterally and intravenously to rats. Radiographs were negative. Carr-Price reagent was used to determine the accumulation of this compound in the liver. No absorption was demonstrated with oral or parenteral administration. Some halogenated vitamin A was found in the liver with intravenous administration but the instability of a water suspension of this compound made intravenous administration an impractical procedure. Further work on solubilization will be necessary before a complete evaluation of the use of this compound in hepatography can be made.
77 pages. $1.00. Mic 56-882

THE DIFFUSION OF GLUCOSE INTO THE HUMAN RED CELL

(Publication No. 13,709)

Richard Christopher Mawe, Ph.D.
Princeton University, 1955

The rate of penetration of glucose into human erythrocytes is investigated by two methods. Firstly, a photoelectric densimeter permits a precise measurement of the volume changes red cells undergo in glucose-saline solutions of varying concentrations. The observed volume changes are compared to theoretical volume changes predicted by a diffusion equation derived from Fick's Law by

Schiodt. Glucose, at concentrations from 0.1 M to 0.4 M in 0.17 M NaCl-PO_4, pH 7.78, at 37 C., enters the human erythrocyte freely, and the volume changes that accompany the penetrations are in agreement with those predicted by Fick's Law. The relative permeability constant, K, for these reactions is 0.16. Only when red cells are exposed to extremely hypertonic concentrations (0.6 M in .17 M NaCl-PO_4) is the K value altered. Slight previous shrinkage of the red cells does not affect the rate of glucose penetration.

Secondly, a chemical analytical technique allows a study of the disappearance of glucose from the plasma of a slightly concentrated whole blood suspension to which glucose in different concentrations had been added. The volume changes the erythrocytes undergo as the glucose penetrates are recorded by hematocrits. Using an equation derived from Fick's Law by M. H. Jacobs, relative permeability constants of 0.9, 0.7 and 0.5 are calculated for the penetration of glucose from external concentrations of 0.14 M, 0.29 M and 0.43 M respectively. Thus, the external concentration of glucose can be doubled (0.14 M to 0.29 M) with slight effect to the "constant". The results clearly show that the rate of penetration (amount of glucose that enters the cells per unit time) is determined by the external glucose concentration. Under the experimental conditions employed, glucose penetrates in a manner predicted by the laws of simple diffusion.

79 pages. $1.00. Mic 56-883

LIPIDOSIS ON THE OXIDATIVE METABOLISM OF RAT AND RABBIT VENTRICULAR SLICES

(Publication No. 15,899)

Bernard Wortman, Ph.D.
The Ohio State University, 1955

The study was undertaken in conjunction with a parallel investigation of the respiratory metabolism of arteries from experimentally induced atherosclerotic rabbits. Heart, particularly ventricular, muscle was used because of its importance in the cardiovascular system, its susceptibility to experimental coronary atherosclerosis (at least in rabbits), its metabolic sensitivity to adrenal cortical and thyroid secretions, and its use as another tissue for determining whether metabolic changes known to occur in experimentally induced atherogenic rabbit artery are tissue specific. Finally, since rat arteries are refractory to the experimental method used to induce rabbit atherosclerosis and since these rat arteriers show metabolic changes, it was of interest to explore the problem of species as well as tissue specificity.

All animals were divided into three experimental groups as based on dietary supplements: (a) normal (controls), no supplement added, (b) 10 per cent cottonseed oil (controls), and (c) 1 per cent cholesterol in 10 per cent cottonseed oil. The rates of endogenous and exogenous oxygen uptake by heart muscle slices were determined by the conventional Warburg manometric technique and were expressed in terms of tissue dry weight (QO_2) and of total tissue nitrogen ($QO_2(N)$). The results of respirometry and biochemical analyses of tissue water and total nitrogen contents were presented as true means (arithmetical means and their respective standard errors). The results are considered probably significant when "P-values" are 5 per cent or less (Student's method). The conclusions are as follows:

1. Water Contents. Rat heart muscles did not show any significant shifts in water, while rabbit heart muscle from the cholesterol-oil group showed a significant decrease in water content when compared with normal and with oil controls.
2. Total Nitrogen Contents. There were no significant changes in total nitrogen contents of rat heart muscles, but there were significant decreases in total nitrogen contents of rabbit heart muscles from the oil and from the cholesterol-oil groups when compared with normal controls.
3. Endogenous Oxygen Uptake. QO_2 and $QO_2(N)$ of rat heart muscle slices from the oil group showed significant increases when compared with normal controls, while the cholesterol-oil group showed significant decreases in OQ_2 and $QO_2(N)$ when compared with oil controls. QO_2 of rabbit heart muscle slices from the oil group showed a significant decrease which was not evident in $QO_2(N)$ when compared with normal controls.
4. Exogenous Oxygen Uptake. Citrate depressed oxygen uptake by rat heart muscle slices from the cholesterol-oil group, while lactate and pyruvate increased oxygen uptake by heart muscle slices from the oil group. All experimental tissues showed an increased oxygen uptake in the presence of succinate.
5. A tendency for intracellular derangements to accompany biochemical processes in lipid metabolism as related to atherogenesis has been demonstrated and discussed in the light of current literature.

58 pages. $1.00. Mic 56-884

A KINETIC BASIS FOR TIME-DEPENDENT PROPERTIES OF ARTERIAL SMOOTH MUSCLE

(Publication No. 15,901)

Marvin Leon Zatzman, Ph.D.
The Ohio State University, 1955

Studies have been made of the factors contributing to the phenomena of stress relaxation and creep in arterial smooth muscle. These phenomena were examined in an effort to elucidate the nature of the underlying mechanisms, and have been related to the molecular reaction rate kinetics involved.

The studies include a reëxamination with improved techniques of stress relaxation curves of carotid artery rings, umbilical artery rings, and segments of the penis retractor muscle of the dog (smooth muscle end). Records obtained of tension vs. time were examined to determine the mathematical nature of the time course of stress relaxation, and the behavior of the three tissues was compared.

An important facet of these studies is the study of the

process which is the reverse of stress relaxation (that is, tension potential recovery).

Also included in thses studies are the derivation and examination of a theory of stress relaxation and recovery of tension potential based on a simple system of reaction rate kinetics of conversion of molecular units making up tissue. The theoretical results are compared with the experimental data.

Conclusions arrived at in these experiments are:

1. The time course of stress relaxation is essentially similar in the three tissues studied. This includes a segment in which stress relaxation is linear when plotted on a logarithm of time basis, over at least two log cycles of time.
2. The time course of recovery of tension potential is almost an exact reversal of the time course of stress relaxation, showing again a segment in which the recovery curve is linear when plotted on a logarithm of time basis.
3. Comparison of these studies with studies of the decay of pressure indicates a fundamental difference. This difference has been attributed to "end effects."
4. When the tissue is subjected to repeated stretches, separated in time by 10 minutes, the amount of stress relaxation decreases with the number of stretches, but the nature of the time course curve remains unchanged.
5. The amount of recovery from stress relaxation increases with repeated stretches, and the curve of amount of recovery vs. number of stretches has been plotted. These results agree with observations that hysteresis loops vary in the first four or five stretches.
6. These experimental results agree well with predicted behavior, if one uses the theory developed for reaction rate kinetics.

The significance of these experiments to the knowledge of the physical properties of arteries, to an understanding of cardiovascular phenomena related to the physical properties of arteries, and to the general field of study of the physical properties of tissues is discussed.

Several problems of promise for future research have arisen from the experiments described herein. These problems are listed. 105 pages. $1.31. Mic 56-885

POLITICAL SCIENCE

POLITICAL SCIENCE, GENERAL

REGIONALISM IN NIGERIA: A STUDY IN FEDERALISM

(Publication No. 14,982)

Eme O. Awa, Ph.D.
New York University, 1955

Adviser: Martin B. Dworkis

Nigeria, Britain's largest dependency today, contains several ethnic groups that existed as separate units prior to the advent of the British. The constitutional development of the country has been checkered by such forces as the idealism of some British thinkers, the dictates of colonialism, and the cultural problems inherent in the Nigerian situation. Down to the period of World Wor II, for instance, this development was carried out in a piecemeal and lopsided manner. The various groups and areas were placed under a centralized administration in 1914. In 1947, a measure of devolution was introduced into artificially created regional units. Four years later, these same regions were recognized as the territorial basis for a federal constitution that was established following the failure of the experiment in devolution.

In the meantime, the educational policy of the government and the educational philosophy adopted by missionary institutions tended to insulate peoples of the northern part of the country from outside influences and to inculcate in the Southern Nigerian a feeling of deprecation toward Nigerian Social and political institutions. Thus there developed a serious dichotomy in the intellectual orientations of the southern and northern peoples. Southern intellectuals mainly have provided political leadership in the situation and have endeavored to arouse national consciousness in the country. But the socio-political dynamics since the introduction of the federal constitution make it clear that this leadership has been unimaginative to the extent of failing to provide a program that successfully accommodates the problems created by the socio-physical diversity of the country. The dynamics of the period make it apparent also that Nigerian federalism is poised on a precarious territorial basis. The country is not adequately subdivided into units small enough to make possible the creation of sufficient centers of deliberation and enterprise. The present constitutional organization therefore falls short of the ideal of federalism as a philosophy of opportunity and a technique of representation.

The development of federalism in the country has been influenced as in the United States, Switzerland, Canada, Australia, Germany and India by the history, sociology and physical configuration of the land. The provisions of the federal constitution reveal evidence of the influence of the ideals of British political practice on the organization of the government. In this respect Nigeria has followed in the paths of Canada, Australia and India.

The country is still subordinated in constitutional theory and practice to Britain. The situation is reminiscent of the subordination of the Provinces to the Dominion Government of Canada by the British North America Act of 1867. It is possible that political power will subsequently devolve on local instrumentalities by convention and usage, as it did in Canada. But in Canada, Britain was anxious to

abolish colonialism. In Nigeria, it is at least an open question as to whether Britain will train Nigerians beyond the needs of British economic nationalism. It is obvious in the Nigerian situation that the evolution of an adequate organization and functioning of a federal government —federalism appears indispensable in the situation now —must be preceded by the eradication of colonialism. The country can then advance with a minimum of friction to the status of a modern state. 309 pages. $3.86. Mic 56-886

MEXICO: AN EXPERIMENT IN ONE-PARTY DEMOCRACY

(Publication No. 13,377)

Frank Ralph Brandenburg, Ph.D.
University of Pennsylvania, 1955

Supervisor: Howard C. Perkins

The republican era of Mexican history—which began with the revolutionary upheaval of 1910-1911 and embraces all the efforts since then toward the integration of Mexican society and the building of a stable and representative government—is called by Mexicans the Revolution. After the early violence of the Revolution had overturned oppressive institutions and practices and Mexico seemed on the threshhold of more prosperous and more democratic times, Mexican leaders sought a means to consolidate and extend the gains already made. The means they found was an official party. Mexico: An Experiment in One-Party Democracy is the story of that party.

The study was motivated by a desire to learn the processes of permanent revolution, to measure the effectiveness of one-party government, and, above all, to appraise the responsiveness or democracy of a single official party operating under conditions unmatched in the history of one-party states. Is the official party a facade for oligarchic tyranny or military dictatorship? Or for one-class rule? Is it government in the interest of the few or the many? Or, on the other hand, is it democracy realized? Or does it merely have a democratic potential? Or is it none of these but something sui generis? To the answering of these queries the dissertation is directed.

An awareness of the poverty of published materials led the author in early 1953 to solicit suggestions from fifty leading scholars, businessmen, and government officials of the United States as to which among the Mexican leaders would be most forthright in submitting to personal interviews. Equipped with these suggestions, letters of recommendation, and aided by fellowships from the Grace and Henry Doherty Foundation and the Frederic Courtland Penfield Committee, the author set off for Mexico in June, 1953. He spent thirteen months there in research in various archives and in talking with political, agrarian, labor, and military leaders, prelates, businessmen, resident foreigners, and others in twenty-nine of Mexico's thirty-two federative entities.

Leaders of the official party have shifted away from platforms demanding a government exclusively of, by, and for labor. They insist that the Party and the Revolution have passed through their necessary anti-foreign, anti-business, anti-Church, and anti-large landholding phases: the PNR and the PRM in the Cardenas epoch provided the media for the masses to expend their pent-up wrath against these special interests. Of course, labor unions, ejidatarios, and the Popular Sector still contend that many goals of the Revolution remain unattained, but constructive rather than disruptive means now characterize their programs. Teamwork and cooperation have become the by-words of politics.

The official party deserves recognition for the fact that it has given relative immunity to criticism. Mexicans enjoy a reasonable measure of freedom of press, freedom of assembly, and freedom of speech. Opposition parties publicly censor many Party members and practices. Abridgments of personal freedom have been rare indeed during the past decade. This tolerance has not, however, extended to the right of effective counter-organization, for, although the official party permits outside groups to organize into political parties and to criticize office-holders, it will not permit them to acquire sufficient power to approach a position from which they might easily become the majority.

The Mexican version of democracy and social justice admittedly still displays many glaring discrepancies between theory and practice. Personalism and corruption not infrequently win out over honesty and morality. But through adjustment and compromise the socio-economic associations that profess to represent Mexican society through the official party have avoided the epilepsy characteristic of the early years of the Revolution. In brief, the one-party system has given Mexico a substantial but certainly incomplete measure of both democracy and effective government. Above all, human rights have been accorded a new dignity. No one can yet say whether Mexico will move forward to achieve the great hopes of her own liberals. 405 pages. $5.06. Mic 56-887

CONGRESS AND ADMINISTRATIVE REORGANIZATION

(Publication No. 15,737)

Nancy Ann Edwards, Ph.D.
Columbia University, 1955

The concern of this study is the relationship between congressional attitudes toward reorganization and the standard executive theory of administrative reform. The executive theory emerged in the progressive era and has been developed and modified. Closely related to the economy and efficiency movement, the doctrine places emphasis on the executive as manager. It rests on the concept that democracy will best be served through an integrated executive branch. Attempts to effectuate this theory – or reorganization proposals which purport to do so – have often met with opposition in Congress. The reasons for congressional attitude and its possible sources in the executive theory itself are important in terms of a fuller understanding of administrative reorganization.

In order to find some of the answers, a historical survey of the reorganization movement was followed by detailed studies of specific reorganization proposals and situations. The choice of the three case studies rested on their representation of different types of reorganization.

Thus transfers of an agency from one location to another, abolition and relocation of the functions of an independent commission, and the creation of a department with cabinet status are the subjects of detailed consideration. The section on proposals to change the location of the United States Employment Service indicates a clear conflict of purpose between Congress and President. Congress refused to give in, revealing that if Congress feels a presidential proposal undermines its control of an administrative agency, the legislature will stand firm. Labor and business interests were concerned here and decisions on each of the consecutive proposals reflected probable effects on the two. Successful abolition of the Maritime Commission in 1950 seemed to rest on three causes. First, it had been clearly shown that the Commission had evaded congressional prescriptions. This produced a reaction in Congress against the Commission. Second, the Commission had few strong ties in Congress even before subsidy irregularities were revealed. Third, the maritime industry itself was so fractionalized that it could not unite to protect the Commission. The 1953 creation of a Department of Health, Education, and Welfare represented success where failure had often been met before. The findings here seem to indicate that if reorganization is sufficiently important to a President, he can succeed if he pays the price asked by interest groups and Congress.

Less intensive study of reorganization proposals illustrates other elements going into a congressman's reorganization decision. Party politics, political views of specific administrators, relation of a plan to some other issue of importance to the legislator, interest group activity – these are some of the types of influence noted and evaluated.

The effect of a reorganization proposal on an agency important to constituents or to some powerful interest group may often be the deciding factor in the mind of a congressman; but certainly significant as well is the congressional attitude toward the executive concept of reorganization. Congress makes the original statement of structure, procedure, and functions in creating the various executive departments and agencies. Through this structural power, Congress has a prior supervision of administration. When reorganization would alter the pattern set by Congress, this may be interpreted as an attack on legislative prerogative. The economy-efficiency rationale used by reorganizers to appeal to Congress is often distrusted by that body as a cover for the end of increasing executive authority and influence. There does seem to be a congressional theory of reorganization which conflicts with the executive doctrine inasmuch as legislative oversight is central to Congress. In many instances this congressional theory is a strong element in congressional decisions.

347 pages. $4.34. Mic 56-888

THE SUPREME COURT SINCE 1937: NINE JUDGES IN SEARCH OF A ROLE

(Publication No. 13,702)

Samuel Krislov, Ph.D.
Princeton University, 1955

The Supreme Court fight of 1937 represented the apex of a series of cumulative popular challenges to judicial power in this century. Though inconclusive and ambigous in its final results, the struggle successfully upset existing conceptions of the Court's role, and shattered the old judicial self-image. Since then the Judges have faced the task of redefining the Court's place in American government, and thus have been forced to sit in judgment upon the judicial function itself.

The present study represents an attempt to chronicle and evaluate the Judges' efforts at reevaluation of Court functions. Court activities are viewed in terms of a systematic breakdown designed to cut across the formal and traditional treatment of constitutional law through legalistic examination of constitutional clauses as the source of governmental power. Rather the effort here is to treat the subject matter in terms of categories representing the effects of Court activity. The Court is conceived of as an "accomodation unit" mediating at crucial points of conflict in the American governmental structure, settling disputes between individual and state, federal-state problems, disputes within the federal departments, conflicts between states.

What emerges most clearly is the absence of any unidimensional pattern of events embracing all the areas covered. Rather, the Court has given searching inquiry to each aspect of its old duties, reassessed them all, given up some, and retained others. The most obvious single phenomenon has been judicial restraint and auto-limitation, but this has not been a universal development. Thus the Court has virtually given up control over the relationship between the individual citizen and the state government in economic matters, but has expanded its activity in the parallel civil liberties questions. Similarly, the Court has allowed greater latitude to state regulation of interstate commerce, but has developed new and vital powers in interpretation of interstate agreements.

The Court has entered with dramatic clarity into the orbit of American political institutions. It has re-essayed judicial functions in the light of social needs. It has shown sensitivity and responsiveness to Congressional and popular demands for judicial creativity in some areas – administrative review and interstate regulation, for example. Similarly, the public has shown an increasing awareness of the Court's political role and has attempted to influence judicial processes in an unprecedented manner, while the Court in its procedures and its methods of opinion-writing has attempted to give weight to public opinion and public relations.

Finally, it is to be noted that in many of those areas in which abnegation was an important motif, the Court either by its own volition or, more frequently, in response to legislative or popular pressure, has reversed the trend in recent years and reasserted a considerable measure of legal control. At the present time, too, virtually all sustained criticism of the Court is concerned with decrying the lack of judicial activity and the decline of judicial authority. The tenor of public and scholarly opinion indicates a demand for greater Court action in the immediate future. More important, it seems to indicate that the Court has successfully weathered the 1937 crisis, has recouped its standing in the public eye. If judicial authority can be expected to be less far-reaching than in the heyday of the due process clause, it can nonetheless be expected to continue as a vital factor in American government.

279 pages. $3.49. Mic 56-889

POLITICAL SCIENCE, INTERNATIONAL LAW AND RELATIONS

ISRAEL AND THE ARAB REFUGEES

(Publication No. 15,746)

Don Peretz, Ph.D.
Columbia University, 1955

Israel and the Arab Refugees traces the development of and probes some of the complexities of Israel's policy toward the Arab refugee problem. The study briefly surveys the origins of the problem, the efforts of the United Nations (UN) to settle it, and the attitudes of the Arab states toward it.

Early attempts to settle the question by refugee repatriation to Israel under UN auspices are reviewed and the reasons for failure are traced. United States intercession and the reaction of the Israel Government and public opinion to American efforts is studied.

By 1954 there was only minor success in repatriating the refugees under the UN scheme for reuniting families broken by the Palestine war.

As efforts to return the refugees to their home failed, the UN turned to an economic solution of the refugee problem. Under the direction of Gordon Clapp, Chairman of the Board of the Tennessee Valley Authority, a UN economic survey mission attempted to draw up an over-all plan for Middle East economic rehabilitation which would provide for Arab refugee resettlement. The obstacles to this solution and Israel's policy toward it are surveyed in this study.

A large part of the study is devoted to the status of the Arab minority in Israel with a view to determining what conditions would be like for repatriated Arab refugees. The security restrictions imposed upon the minority and the reasons for these restrictions are analysed, as are some of the other areas of sensitivity such as nationality legislation, Israel's program for Arab local government, education, and administration of religious affairs.

The study reaches the conclusion that despite many asperities in the life of Israel's Arabs, there have also been many positive changes in their economic and social status since the end of the Palestine war. In the final analysis, the dichotomous position of Israel's Arab minority – caused on the one hand by the legal matrix which circumscribes its daily life, and on the other by the improvement in its material and social welfare – produces an intensifying psychological dilemma which may eventually lead to a clash.

The economic impact of the Arab flight upon Israel is examined, especially with regard to the question of abandoned refugee property. The property was of vital importance in making possible the creation of the new state. The government's initial policy of indecision and development of legislation leading to absorption of refugee property into Israel's economy is traced.

Initially the question of compensation for refugee property was left open but under pressure from the international community, Israel finally committed itself to payment. Some of the technical difficulties in property evaluation and identification as well as problems involved in payment of compensation are reviewed in the study.

Release of Arab refugee accounts blocked in Israel banks was another of the many problems involved in the refugee question. The three-way negotiations between the UN, the Arab states, and Israel leading to release of the accounts is treated in the study as part of the compensation problem.

The study concludes that there can be no quick remedy for the refugee situation. The use of a large plan, a fresh approach, or a new face cannot break the impasse, nor can forceful diplomacy. Time as a heeling element is the most important factor in coping with the psychological disturbances created by the Palestine conflict. Until a stable social and political foundation has evolved in the Arab world, there can be no feasible solutions for problems like that of the Palestine refugees. The fundamental enigma is how to use a policy of gradualism soon enough to prevent the Palestine issue from becoming a point of major international conflict.

438 pages. $5.48. Mic 56-890

PSYCHOLOGY

PSYCHOLOGY, GENERAL

THE RELATIONSHIP BETWEEN SOCIAL CLASS IDENTIFICATION AND ATTITUDES TOWARDS OCCUPATIONAL EXPECTANCIES

(Publication No. 15,732)

Paul Beryl Bachrach, Ph.D.
Columbia University, 1955

Purpose of the Investigation

This study was undertaken to determine whether there exists a set of vocational attitudes related to class identification, the existence of which might shed light on the process of vocational development. Specifically, the relationship of class identification to a multiplicity of vocational factors was explored, such as prestige level of occupational expectancy, confidence in occupational expectancy, work values, and factors considered necessary for success. In addition, the relationship between class identification, self-classification and status was examined as well as those factors commonly considered to contribute to class identification and self-classification.

Procedure

The subjects comprised 17 high school classes, with a number ranging from 318 to 378. The mean age was 16 1/2 years, and the mean Pintner IQ was 114. The Sims SCI Occupational Rating Scale was administered to determine social class identification and a Student Questionnaire to ascertain vocational expectancies. The relationship between class identification and self-classification

and the vocational variables elicited were studied by correlation techniques.

Results and Conclusions

1. The mean occupational expectancy of the sample was somewhat high corresponding to the occupation of railroad engineer or public school teacher. Significant but low correlations were found between social class identification and prestige level of occupational expectancy.

2. Optimism regarding chances of rising in the world markedly characterized the sample. Upper class identifiers, however, are significantly more optimistic than the lower class identifiers.

3. Work values emerge as a combination of self-expressive and material. There are significant differences between the work values of middle and upper class identifiers as opposed to lower. The former tend to seek self-expression in work, whereas the latter veer towards material and security values.

4. Success is commonly believed to result from personal assets, careful vocational choice, and hard work as opposed to breaks, family connections, and money. There is no significant difference between upper and lower class identification concerning this issue.

5. Satisfaction witn occupational expectancy characterizes the sample, with no significant differences between upper and lower class identification.

6. A fair degree of confidence in attaining the occupational expectancy is manifested by a majority of the students. Again, there is no significant difference between upper and lower class identifiers.

7. Four factors stand out as contributing to self-classification—father's occupation, father's earnings, people with whom the family associates, and how the family thinks and acts. Upper class identification differs significantly from lower in only one item—the part of the city in which you live. Upper class identifiers tend to feel this is not important, whereas lower class identifiers consider it important.

8. Roughly 75% to 80% of the students identified with and classified themselves in the middle and middle-working classes.

9. Status, class identification, and self-classification are significantly intercorrelated. These correlations, however, are not so high as to warrant interchange in social analysis.

10. In this study, self-classification and social class identification appear to yield roughly the same findings.

Generally, the existence of class identification vocational attitudes appears supported. Upper class identifiers tend to expect more prestigeful occupations, are more optimistic with respect to rising in the world, and tend to seek self-expressive rather than material values in work.

Implications for Further Research

Certain methodological changes in collecting data are suggested. The need for a sample embracing the entire class continuum is emphasized. A measure of personality would appear to be a useful adjunct to further study in this area. Finally, the relationship between vocational expectation and actual vocational attainment might be investigated by longitudinal study.

94 pages. $1.18. Mic 56-891

THE METHOD OF RECIPROCAL AVERAGES IN THE ANALYSIS OF PERSONNEL DATA

(Publication No. 14,441)

Edward Robert Carr, Ph.D.
Purdue University, 1949

Major Professor: Joseph Tiffin

A study in applied psychology investigating the applicability of the method of reciprocal averages as a methodology for weighting personnel data to predict at the time of employment various criteria of job performance.

The four criteria of job performance studied were job tenure, absenteeism, number of hospital visits due to injury, and number of wage increases. The weights for the categories of personnel data were established with a primary group of employees and cross validated on a holdout group of employees for each of the criteria.

The method functioned with the greatest degree of success when applied to the criteria of job tenure, and number of hospital visits for injury.

The predictive value of each of the criteria was markedly increased when mean scale scores were based on personnel data usually available at the time of employment plus certain categories (hospital and absence records) not usually available at that time.

This study of the method suggests not only that it has possibilities for prediction with criteria of job performance and the discarding of inappropriate data from application blanks, but that the effectiveness of present employment procedures would be increased if additional data were obtained on potential employees at the time of employment.

347 pages. $4.34. Mic 56-892

AN INVESTIGATION OF ATTITUDE STRUCTURE AND SOME HYPOTHESIZED PERSONALITY CORRELATES

(Publication No. 15,197)

Rhea Stagner Das, Ph.D.
University of Illinois, 1955

The concept of attitude structure refers to the organization of attitudes within the individual personality. It is proposed that one important aspect of attitude structure is the consistency of attitudes toward objects which are considered to be related in our culture. Attitude structure is conceived as a significant aspect of cognitive functioning, and theoretical arguments support the prediction that as a system it is related to the total personality organization.

Empirical data were gathered to test two hypotheses: (1) that individual differences in integration and stability of attitude structure could be measured reliably; and (2) that persons relatively high on measures of attitude structure would differ significantly, as regards selected personality characteristics, from persons low on these measures of attitude structure.

A set of religious attitudes was chosen as a basis for deriving attitude structure measures. Six such attitudes were measured, using controlled word association tests

developed for this research. Intercorrelation of the tests indicated that they were all significantly and positively related to each other. Integration, defined as the intraindividual variance of the six attitudes in standard scores, and stability, as the sum of test-retest differences in standard scores for the individual, were the dimensions of attitude structure measured. Ten factor scales from a factorial personality questionnaire, the "Sixteen Personality Factor Questionnaire", were used to obtain measures of the hypothesized personality correlates. One hundred and forty eight students in undergraduate psychology classes, both men and women, at the University of Illinois served as subjects.

The results indicate that integration and stability of attitude structure, as defined, can be measured reliably. Further, integration and stability are positively correlated. As regards the hypothesized personality correlates, relationships must be treated as suggestive rather than firmly established. Integration appears to be correlated with factor Q_2, low integration being associated with independent self-sufficiency; and stability appears to be correlated with factor C, high attitudinal stability being associated with emotional stability.

We conclude from these results that the more integrated (internally consistent) attitude organization is more likely to show high stability over time and to be correlated with the negative pole of factor Q_2 (lack of self-sufficiency). Stability as measured was found to be associated with the positive pole of factor C. In terms of these results, we reinterpreted integration as conformity to culturally popular attitude patterns, such that the highly integrated attitude structure conforms to the expected patterning of the several attitudes in the population.

183 pages. $2.29. Mic 56-893

NEGATIVE TRANSFER AND RETROACTIVE INHIBITION IN CONCEPT AND PAIRED ASSOCIATE LEARNING AS A FUNCTION OF STIMULUS SIMILARITY BETWEEN ORIGINAL AND INTERPOLATED TASKS

(Publication No. 15,855)

John Samuel Loper, Ph.D.
The Ohio State University, 1955

A survey of the literature of attempts to relate concept formation to learning variables or constructs was made. Several studies dealing with distributed practice, reinforcement, and interconcept stimulus generalization were summarized. Only one investigation touching indirectly on intraconcept stimulus generalization was found.

The study is an attempt to test the widely held commonsense opinion that conceptualization involves complete transfer or generalization from one stimulus to another within the same class or concept, the assumption being that a new concept stimulus is instantaneously recognized and responded to as a member of that class.

Since positive transfer has been the operation by which concepts typically have been defined, it was decided to employ negative transfer and retroactive inhibition in testing the hypothesis. The learning paradigm S_1-R_1, S_1-R_{1_R}, S_1-R_1 was utilized. The S_1-R_{1_R} in the interpolated learning (IL) refers to the fact that the same stimuli and responses used in the original learning (OL) were repeated in this condition but repaired. Antagonistic responses were thus set up to produce maximum negative transfer and retroactive inhibition. Since transfer is greatest when identical stimuli appear in the OL and in the IL, the transfer value of different though similar stimuli employed in the IL can be measured by comparison with this condition of maximum transfer.

The conceptual scheme employed in designating groups in the study is as follows: Roman numerals refer to the type of learning, odd numbers to concept learning, and even numbers to S-R learning. Letters designate the kind of IL received, "A" referring to identical stimuli in both the OL and IL, and "B" referring to stimuli in the IL different from those in the OL although still of the same class. For example, Group IA refers to a concept group learning identical stimuli in both OL and IL, Group IIB refers to an S-R group learning different stimuli in the IL.

The hypothesis stated concerning the groups employed in the present study is: Groups IA and IB should not differ significantly in their performances on IL and relearning. Groups IIIA and IIIB (identical with Groups IA and IB except that they received additional training on OL and IL) also should not differ. Group IIA should be significantly inferior to Group IIB on IL and RL.

Three measures were employed in the analyses: (1) total number of correct responses, (2) decrement (RI) on the first three relearning trials, and (3) intrusion errors.

Most of the obtained results are positive. However, certain complicating factors force the author to reject these as conclusive support for his hypothesis.

49 pages. $1.00. Mic 56-894

AN INVESTIGATION OF SOME PERCEPTUAL TASKS PERFORMED BY EXOGENOUS AND NORMAL CHILDREN

(Publication No. 14,416)

John Frederick Mesinger, Ph.D.
Purdue University, 1955

Major Professor: Newell C. Kephart

This study was concerned with an investigation of certain perceptual tasks among children at two training schools for cerebrally injured children and at a county public school. The study was designed to demonstrate a fundamental inability to synthesize wholes from parts or part information when the effects of psychometric intelligence are eliminated. Figure-ground difficulties were investigated as an attendant phenomenon.

Nineteen children with various classifications of brain injury were selected from a larger group on the basis of higher intelligence and were compared with nineteen control subjects who were matched for age.

Age and IQ score were recorded for each subject. A battery of five tests derived from a theoretical model was hypothesized to test the ability to perceive figure-ground relationships which is believed to depend upon the ability to synthesize or perceive wholes from a proper meaningful perceptual organization of their parts. The Form

Emergence Test, a Pegboard Test, the Light Gestalt Test, Embedded Designs Test and Dotted Outlines Test were presented to all subjects in the same order.

Statistical analysis relying primarily on t tests, analysis of variance and analysis of covariance tests indicated that in each test the exogenous children as a group were less accurate. This is explained in terms of ability to synthesize wholes by a proper meaningful organization of their parts. 70 pages. $1.00. Mic 56-895

SOCIO-EGOCENTRISM IN DELINQUENTS AND NON-DELINQUENTS

(Publication No. 14,420)

James Sedalia Peters, II, Ph.D.
Purdue University, 1955

Major Professor: H. H. Remmers

In this study the major problem was to see if delinquent individuals (in the legal sense) differ from non-delinquents in attitudes and feelings for themselves and others, and if so, how and what is the relationship and direction of this difference.

Following an introduction to the concept of self-others attitudes (socio-egocentrism) an attempt was made to show its importance for psychological theory, personality adjustment, counseling, and social-psychological application. Afterwards, a definition of socio-egocentrism was given, and the problem of studying its manifestation was discussed. The question as to how best to study socio-egocentrism was considered, basic assumptions made, and design of study presented.

This study is an analysis of self and social orientation of institutionalized delinquent adolescents, and adolescents who belong to the clubs of the Y.M.C.A. for high school boys and girls (Hi-Y and Tri-Hi-Y). The delinquent boys and girls were inmates of The Illinois State Training School For Boys, St. Charles, Illinois, and The Illinois State Training School For Girls, Geneva, Illinois. The Y.M.C.A. boys and girls were from the greater Chicago and greater Indianapolis areas. The delinquent group was composed of 132 males and 35 females; the non-delinquents 123 males and 41 females. The total population (delinquent and non-delinquent) was 331. The age range for both groups was 13 to 19.

All 331 subjects were administered twelve Semantic Differential Scales and a modification of the SRA Youth Inventory. These were scored and statistically analyzed by two-way classification analysis of variance method. Correlations were run on self-others measures, and the total scores for the delinquents against the total scores for the non-delinquents.

The statistical analysis of results support the specific and major hypotheses. The major ones are as follows:

1. An investigation of socio-egocentrism of delinquents and non-delinquents using Semantic Differential Scales will reveal differences in self-concept and social perception of delinquents and non-delinquents.

2. There is a positive relationship between an individual's self-concept and his social perception as measured by Semantic Differential Scales. There is a positive correlation between attitudes and feelings toward self and attitudes and feelings toward others.

All of the F tests were significant at either the .05, .01, or .001 level. Interaction was significant for several of the variables.

In the discussion that followed the results were integrated to other psychological and sociological findings. Following this, implications were drawn from the results, and conclusions were made.

149 pages. $1.86. Mic 56-896

GENERALIZATION OF AN INSTRUMENTAL RESPONSE AS A FUNCTION OF PARTIAL REWARD DURING TRAINING

(Publication No. 15,660)

Ellis Loche Van Atta, Ph.D.
State College of Washington, 1955

This study was designed to determine the relationship between partial reinforcement during training and stimulus generalization, three criteria being employed to measure generalization as a function of reinforcement schedule during training.

Three groups of thirty-five albino rats each were trained to push open a door in the center of a white circle 79 sq. cm. in area. All animals received fifteen trials per day on four successive days. One group received sixty reinforcements in sixty trials (100%), a second received forty reinforcements in sixty trials (66.7%), and a third received twenty reinforcements in sixty trials (33.3%). The pattern of partial reinforcement was semi-random.

Twenty-four hours following completion of training, each acquisition group was divided into five sub-groups of seven animals each, which then received thirty non-reinforced test trials to either the 79 sq. cm. training circle, or to a stimulus of 63, 50, 32, or 20 sq. cm. in area. Performance during extinction was measured in terms of median latency of the first three test trials, number of responses made within sixty seconds' cumulative response time, and total number of responses in thirty trials. Training and extinction trials were spaced fifteen minutes apart.

Three major hypotheses were tested. These were:

1. When training trials are widely spaced, there will be no difference between acquisition scores for partially and continuously reinforced groups.

2. When measured by criteria based upon the first few extinction trials, 100 per cent reinforced animals will show greater response strength at every point along the generalization continuum than partially reinforced animals, amount of generalized response strength at any point being positively related to number of reinforcements during training.

3. When measured by criteria based upon a prolonged series of extinction trials, partially reinforced animals will show greater response strength at every point along the generalization continuum than 100 per cent reinforced animals, amount of generalized response strength at any point being inversely related to number of reinforcements during training.

The acquisition performance of the 100 per cent group

was consistently superior to that of the partially reinforced groups; however, the differences obtained were not statistically significant. Hypothesis number one is thus confirmed.

The relative height of the generalization gradient for each reinforcement group was found to be a function of the criterion employed. When measured by median latency of the first three extinction trials, the 100 per cent group was superior to the partially reinforced groups beyond the .001 level of confidence, and a positive relationship was revealed between amount of generalized response strength and number of reinforcements during training. This result confirms hypothesis number two. Even though the 100 per cent group was superior to the partially reinforced groups when measured over the first few extinction trials, the partially reinforced groups exhibited much greater resistance to prolonged extinction at the training point.

For the sixty-second criterion, an analysis of variance technique revealed no differences among the three gradients. When measured by the thirty trials criterion, an analysis of variance technique revealed the 33.3 per cent group to be superior, height of the gradient at any point being inversely related to number of reinforcements during training. This result, significant between the .05 and .01 levels of confidence, confirms hypothesis number three.

On the basis of the composite findings regarding generalization as measured by extinction criteria, it was suggested that only the initial few extinction trials be utilized in determining the manner in which what is learned generalizes, and that measures derived from prolonged extinction series be regarded as essentially performance indices related to the ease of maintaining the response.

72 pages. $1.00. Mic 56-897

A STUDY OF CERTAIN "SEEING" VARIABLES IN RELATIONSHIP TO THE EFFICIENCY OF INDUSTRIAL INSPECTING

(Publication No. 15,080)

Joseph William Wissel, Ph.D.
Purdue University, 1950

Major Professor: N. C. Kephart

A research problem in applied psychology which deals with the efficiency of roller bearing inspectors under five pairs of experimental conditions.

One male and three female subjects examined tapered rolls which passed through a stock model inspection machine. Two conditions of classification, lighting, machine speeds, duration of testing periods and spider finishes were used. A factorial design allowed one of each pair of variables to be presented simultaneously. Each lot contained seven types of rolls with surface defects in numbers equaling 10% of the total lot. Each subject took 32 tests which required a period of 10 hours testing. This limited activity to about two hours of testing time per day.

Results were analysed according to total defect scores and total composite scores. The former took only the defective rolls selected into account and the latter took both the OK rolls selected and the defective rolls missed into consideration. Four lots of different lengths were used so the raw data had to be converted to proportionate scores. Total defect scores were thought to be more important since the exact relationship between OK and defective rolls was not known. Combined results for total defective scores indicated that performance was superior under a multiple classification system, a machine speed of 49 rolls per minute, a testing period of 8 minutes duration and a dull finish spider. Neither lighting condition used was found to be significantly superior to the other.

It was thought all seven types of defects were not contributing equally to the total scores so an individual defect analysis was made. Differences between means and σs were found for scores of all defects and Pearsonian r's were computed. Only 21 of 84 r's computed were found to be significantly non zero.

Individual defect scores were analyzed under all experimental conditions. It was found that some conditions were favorable for one type of defect and unfavorable for another. Other defect scores were not influenced by changes in experimental conditions.

Further research is suggested and a Graeco-Latin type square design is recommended for expanded research in which analysis of variance may be used.

150 pages. $1.88. Mic 56-898

PSYCHOLOGY, CLINICAL

THE RELATIONSHIP OF MATERNAL UNDERSTANDING OF THE CHILD AND ATTITUDES TOWARD THE CHILD TO THE ADJUSTMENT OF THE CHILD

(Publication No. 15,557)

Laurence S. Baker, Ph.D.
New York University, 1955

Chairman: Professor Bernard Kalinkowitz

The purpose of the present study is to investigate the relationships among maternal understanding of the child, maternal attitudes towards the child, and the child's adjustment. Five specific hypotheses dealing with these interrelationships are offered.

The problem is of importance to workers in the fields of psychology, education, parent education and allied professions. Various writers have studied these relationships in a largely indirect manner, in an attempt to discover the nature of empathy and the effect of parental attitudes; relatively few direct experimental studies have been carried out.

The California Test of Personality, Intermediate Series, Form AA, was administered to the students in regular grades seven through nine in a public school. Students achieving scores in the extreme quartiles of the test norms were categorized as adjusted and maladjusted. Mothers of the children in the two groups who indicated willingness to participate answered the questions on the U. S. C. Parent Attitude Survey, and each attempted to predict the answers of her child on the California Test. The groups were

essentially similar in socio-economic status, child intelligence, marital stability, education and age.

The child's adjustment is found to be unrelated to the mother's predictive accuracy on his deviant answers to the California Test although highly related to his total answers. The mother's attitudes as measured by the U. S. C. Survey are found to be independent of her empathy as measured by her accurate prediction of deviant California answers. No difference occurs in the accuracy of prediction for boys and for girls, adjusted or maladjusted. Five areas of the California Test are sensitive to the child's adjustment as reflected in maternal empathy. These comparisons made through the use of biserial and product-moment correlative techniques, and their significance tested through the use of the T-test.

It is suggested that the discrepancy between accuracy of maternal prediction of the child's total answers and of his deviant answers on the California Test occurs because of a constant, stereotyped response on the part of the mother which is biased towards "approved" or "good" answers. With this constant excluded through use of the accuracy of prediction of deviant answers, the adjusted and maladjusted children are seen to be equally well understood by their mothers in the groups studied; several personality areas appear to be better understood by mothers of maladjusted children and several by mothers of adjusted children; mothers demonstrate the same understanding for boys and for girls, adjusted and maladjusted; the mother of the adjusted child is seen to be less dominating and possessive and to demonstrate a lesser negative attitude toward the child than the mother of the maladjusted child. The mother's ignoring attitudes are not found to be related to child adjustment, or maternal attitudes to maternal empathy. To a limited degree, the California Test is seen to be usable as a predictor of maternal attitudes; and the U. S. C. Survey appears successfully to differentiate between adjusted and maladjusted children on the basis of three of the four subscales as well as the total score.

Should the present findings be verified by additional research, it is suggested that some modification of parent education and mental health education be devised which would provide more effective help in the development of attitudes and behavior leading to mental health. Further investigation into the studied interrelationships is suggested in order to provide a sounder basis for that part of clinical psychological practice which deals with parent-child relationships. 149 pages. $1.86. Mic 56-899

A STUDY OF AN ASPECT OF CONCEPT FORMATION IN BRAIN-DAMAGED ADULTS WITH APHASIA

(Publication No. 15,562)

Mildred Bloom Bressler, Ph.D.
New York University, 1955

The study investigated the ability of twenty male brain-damaged individuals with aphasia to solve an abstract problem involving the exercise of complex intellectual processes in concept formation. Their performance was compared with twenty male brain-damaged individuals without aphasia and with a "normal" hospital group of twenty males without brain damage or aphasia. They were given a personal interview, a Pseudo-Isochromatic test, a modified Wechsler-Bellevue performance scale and a Concept Formation Test.

The variables of the Concept Formation Test were analysed in order to evaluate the relationship among the diagnostic groups, the premorbid conceptual level and the interaction between these two factors. The data were analysed by testing the differences among the mean scores, utilizing a 3 x 2 factorial analysis of variance design.

The Wechsler-Bellevue performance scores were explored in a similar way.

The final problem was a correlation of the Concept Formation Total score with the Wechsler-Bellevue performance scores.

The differences occurring among the three groups, significant at the .05 level of confidence were:

1. For the variables of the Concept Formation Test, i.e., total score, time score, time-help score and clue score:

   a) The diagnostic groups differ among themselves significantly in mean scores. The one exception was the time score for the first trial.

   b) On the conceptual level, the high group differs significantly from the low group in mean scores on the total score and the clue score. The high group did not differ significantly from the low group on either the time-help score or the first or second time trials.

   c) None of the interactions between diagnostic group and conceptual level were significant.

   d) For all the variables, there were significant differences between the mean scores of the normal and brain-damaged groups and the mean scores of the normal and aphasic groups. The one exception was the time score for the second trial.

   e) For all the variables, there were no significant differences between the means of the two brain-damaged groups.

2. For the Wechsler-Bellevue Performance Score:

   a) The differences among means were significant beyond the one per cent level for diagnostic groups and conceptual level, but interaction differences were not significant.

   b) The differences between the means of the normal and brain-damaged groups and the normal and aphasic groups were significant. The differences were not significant for the aphasic and brain-damaged groups.

Comparison of the C.F.T. Total Score and the Wechsler-Bellevue Performance Score:

   a) The results were similar for both tests. Differences among means were significant for diagnostic groups and conceptual level, but interaction differences were not significant.

   b) The differences between means for the normal and brain-damaged groups and the normal and aphasic groups were significant, but were not significant for the aphasic and brain-damaged groups.

There was a significant measure of correlation between the C.F.T. total score and the Wechsler-Bellevue performance score for the brain-damaged and the normal groups but not for the aphasic group.

For the aphasic group, there was no significant measure of correlation for the C.F.T. total score and the Wechsler-Bellevue scores except for the object assembly sub-test.

For the brain-damaged group without aphasia, there was a significant correlation for all scores except for the picture arrangement sub-test.

For the normal group, there was a significant correlation for all scores.

The general conclusion that may be drawn from the study is: There is no greater impairment in the conceptual ability of the aphasics than of the non-aphasics when the severity of brain injury is roughly equated. The "normal" group with no aphasia or brain-damage do considerably better than the two brain injured groups.

95 pages. $1.19. Mic 56-900

A STATISTICAL STUDY OF SEX DIFFERENCES ON THE RORSCHACH

(Publication No. 15,682)

Stanton B. Felzer, Ph.D.
Temple University, 1954

Problem

This study was concerned with a statistical analysis of personality differences between males and females as revealed by a projective test, the Rorschach technique, and by a paper-pencil type questionnaire, the Guilford-Zimmerman Temperament Survey. The main objective of the study was to analyze the major factors measured by these two tests in order to determine those areas where definite sex differences existed. The problem under consideration was studied as follows:

1. The analysis of personality differences between a population of males and females.
2. The analysis of personality differences of subjects separated according to an external masculinity-femininity score, the Guilford-Zimmerman M-F scale. This analysis was made on the data from the following four groups:

   a. "Masculine" males
   b. "Non-masculine" males
   c. "Feminine" females
   d. "Non-feminine" females

Procedures

The population used in this study was restricted to 100 males and 100 female undergraduate students from Temple University, with an equal representation for each sex from each of the college classes (freshmen, sophomores, juniors, seniors). Volunteer subjects were used, drawn primarily from introductory psychology classes, with a representation from each of the undergraduate colleges—Liberal Arts, Teachers, and Business. The groups were equated with respect to total score on the American Council on Education Psychological Examination and on the basis of chronological age. Insofar as was known, no subjects were included who had ever undergone any form of psychiatric treatment. No subject was used who had been administered the Rorschach at any previous time. All Rorschach tests were administered by the author in accordance with the techniques recommended by Klopfer and Kelley. This included performance proper and inquiry with exclusion of any testing of limits. The Guilford-Zimmerman was always administered after the Rorschach.

Results

The most significant finding of this study was the fact that practically no sex differences were apparent in the various Rorschach areas. Of the twenty-six variables studied differences between males and females were found in only two. One of the factors which did reveal differences was in the greater use of FC by the females. Despite the superiority of the females in their greater use of FC, however, this did not influence the total color response sufficiently to cause a difference in sum C for males and females. Interpretation of this difference in FC would point out the females as showing more ready control over emotional situations without loss of responsiveness. This might imply that the females could reply with both feeling and action appropriate to the emotional demands of the situation and thus show a better response to social situations and to other people.

The only other Rorschach variable which was found to show differences between the sexes was in the average time per response (T/R) taken by the subject. Males took significantly more time per response than did the females. Interpretation of this finding was made with caution because of the lack of any valid research as to the true meaning of this variable. The possibility existed that either the males took this additional time in order to present greater detail with their responses, or else there was some tendency for the males to be cautious and guarded concerning their given responses.

Analysis of the records with respect to the interaction and interrelationship of Rorschach variables as revealed by the use of three ratios (M : sum C, M : FM, F%) failed to point out any significant differences between the males and females.

When the total sample was classified according to masculinity-femininity score from the Guilford-Zimmerman Temperament Survey, no significant differences were found in Rorschach variables that were not found in the analysis of the total sample of males and females. The only two variables which showed significant differences were FC and T/R, the same two variables noted with the total population. The most adequate handling of emotional stimuli and the most socially adaptive responses were made by females and masculine males. Despite the earlier finding that the total population of females gave significantly more FC responses than the males, this same difference was not noted between the females and masculine males, indicating that the most inadequate use of FC was that made by the non-masculine males.

On the Guilford-Zimmerman Temperament Survey the females considered themselves as being more sociable, cooperative, and friendly than the males. This finding was in keeping with the Rorschach results, and both pointed to a more favorable adaptation and adjustment to emotional and social situations on the part of the famale.

When the total sample was broken down according to

Guilford-Zimmerman M-F score, the non-feminine females considered themselves as showing a greater amount of restraint than any of the other groups and also considered themselves as showing better personal relations—getting along with other people. Both groups of females also scored themselves as more friendly than the males. It was also found that the masculine males and non-feminine females considered themselves as the most emotionally stable and objective of the groups.

Conclusions

I. There were found to be no statistically significant differences between males and females in 24 of the 26 Rorschach variables studied.

A. Females gave significantly more FC responses, showing a more ready control over emotional situations without loss of responsiveness. This might also indicate a more adequate control of emotional aspects of life than that shown by the males.

B. Males took more time in their responses to the Rorschach, indicating either a need to give responses with greater detail or else a tendency on their part to be more cautious and guarded concerning their responses.

C. Data from the Guilford-Zimmerman Temperament Survey showed that the females considered themselves as being more socially responsive and more friendly and sociable than the males.

II. Consideration of the population according to masculinity-femininity of emotions and interests, as shown by the Guilford-Zimmerman, revealed no differences on the twenty-six Rorschach variables which did not reveal themselves in the total population. Significant differences between the groups were found in only two of the variables studied. The groups considered as part of this aspect of the problem were: masculine males, non-masculine males, feminine females, non-feminine females.

A. The feminine and non-feminine females as well as the masculine males gave significantly more FC responses than the non-masculine males. There was no difference in this adaptive use of color between any of the female groups and the masculine males. This would indicate that the most inadequate use of FC was that made by the non-masculine males.

B. Masculine males spent more time per response than non-feminine females, and non-masculine males spent significantly more time per response than either feminine females or non-feminine females. The tendency was thus noted, as was true of the total population, that the male groups took longer time per response, indicating either a need for the males to give greater detail with their responses, or else that the males were more cautious and guarded concerning their responses.

C. Guilford-Zimmerman Temperament Survey results indicated that:

1. Non-feminine females thought of themselves as showing a greater amount of restraint than any of the other groups and considered themselves as showing better personal relations—getting along with others.

2. Both groups of females scored themselves as more sociable than the non-masculine males and considered themselves as significantly more friendly than both groups of males.

3. Masculine males and non-feminine females considered themselves as the most emotionally stable and objective of the groups.

135 pages. $1.69. Mic 56-901

AN INVESTIGATION OF SOME OF THE PHYSIOLOGICAL AND PSYCHOLOGICAL EFFECTS OF SUB-SHOCK DOSES OF INSULIN

(Publication No. 15,902)

Paul Raymond Fuller, Ph.D.
Indiana University, 1952

This experiment was a study of the time/dosage relationship in the effects of insulin sub-shock therapy (IST) on the electro-cardiograph, the blood-sugar level, the learning of a stylus maze, and the learning of lists of paired words.

The dosages studied were zero, 20, 40, and 60 USP units of regular insulin. The Ss were tested 10, 40, and 70 minutes after injection. Insulin tolerance curves were obtained from 18 Ss, six in each dosage group. Twelve electrocardiograms were obtained.

Ss were 72 cooperative, non-psychotic, white male World War II veterans, hospitalized in a Veterans Administration Hospital. All Ss had been selected to undergo IST by the staff psychiatrists, but the control groups were not receiving insulin at the time they served as subjects for the experiment.

Insulin tolerance curves revealed a drop in blood-sugar level which began shortly after injection and continued until a minimum level was reached approximately 75 minutes after injection. The blood-sugar level tended to rise before termination procedures were instituted by the hospital staff. ECG revealed a slight increase in rate, but no ischemia or hypokalamia.

Maze learning was apparently facilitated by the smaller doses of insulin particularly soon after injection, but learning was retarded following 60-unit injections. This is particularly interesting when the fact that 60-unit injections did not lower the blood-sugar level so much as did 20 or 40-unit doses.

Ss who received insulin made fewer errors in the paired associate learning than did the control Ss. Time apparently was not a significant variable in this task.

These results were considered in terms of two hypotheses; one of which involved the concept of disinhibition due to insulin, and the other of which involved the Hullian concept of an irrelevant need.

49 pages. $1.00. Mic 56-902

THE ROLE OF LANGUAGE AS A CUE IN LEARNING AND EXTINCTION

(Publication No. 15,848)

James Neal Joyce, Ph.D.
The Ohio State University, 1955

A complete theory of language does not seem feasible at the present stage of the social sciences. It may be that its complexity will defy understanding from any one point of view. In spite of this complexity and lack of complete theoretical formulation, the function of language in human behavior may be studied with profit at an empirical level. At the level of the experiment, the experimenter's cues might vary in the degree to which they directed the subject to the appropriate stimuli. Also, the subject's conceptualization, or symbolization, of the situation might vary in adequacy.

There were seven groups of subjects, with 20 subjects in each group. The experimental groups were to learn the verbal habit of giving sequential associations to a list of stimulus words. A word was read to the subject, who gave a word or phrase that occurred to him in relation to that stimulus word. Following each association, the experimenter gave a positive or negative reinforcement, depending upon whether or not the subject gave a sequential association. Some subjects were asked to state the principle and some verbalized it more often than others. Some received a cue at the beginning of the learning trials suggesting that a principle could be found. Some received a cue at the start of the extinction series suggesting that the situation might change. Measures were made of the effects of the different kinds of cues and the effects of the different number of verbalizations of the principle on the learning and extinction of the habit and on the adequacy of conceptualization of the principle.

The raw data consisted of the number of sequential responses for every trial, the adequacy ratings for each concept, and the Ohio State Psychological Examination score for each subject.

The results indicated that verbalized concepts could be rated on a scale of adequacy of concept with a high degree of correlation between raters. Those subjects who verbalized more adequate concepts performed more adequately during the learning and extinguished more rapidly during the extinction. Apparently, being able to conceptualize what has been learned will facilitate change in behavior once the situation changes.

One of the factors influencing adequacy of conceptualization was the verbal intelligence of a subject; however, in this study the contribution of intelligence was small. Other factors, such as the amount of training a person has had might be found to be of great importance. The indirect cues from the experimenter that a principle might be found and that the situation might change did not seem to influence significantly the conceptualization or performances of the subjects. Perhaps the cues were not effective because many subjects cued themselves in much the same fashion. These results would indicate that cues need to be more directive than the ones used in the study in order to affect the performances of the subjects.

Repeated attempts at verbalization of the concept did not increase the adequacy of construct; however, the repetitions did seem to help the subject become more aware of the referents of his construct and thereby facilitated extinction when the situation changed. Perhaps many subjects implicitly verbalized during the experiment, and the cue effect of explicit verbalization was not effective until the situation changed. In the study two factors were found that facilitated extinction. One was attempted explicit conceptualization while learning was taking place. The other was adequate conceptualization of what had been learned. Both factors seemed to help the subject become more aware of the referents for his concepts and thereby increased awareness of the change in the situation.

104 pages. $1.30. Mic 56-903

THE EFFECTS OF ALCOHOL ON FEAR EXTINCTION

(Publication No. 15,742)

Helen Singer Kaplan, Ph.D.
Columbia University, 1955

The aim of the investigation was to study certain aspects of the process of fear extinction under experimental conditions. An attempt was made to determine whether pairing of a fear-evoking stimulus with a chemically induced state of reduced fear facilitates the extinction of a fear motivated escape response. The degree of fear extinction was inferred from the strength of the escape response.

Four groups of eight albino rats each served as subjects. The experiment was conducted in three phases. During the first phase, on days one and two of the experimental cycle, each animal ran 60 acquisition trials in which a neutral stimulus, the white compartment of the Miller box, was paired with an aversive stimulus, electric shock. The subjects learned to escape shock by running into the black compartment.

On the third experimental day, during the extinction phase, the subjects were confined in the white compartment and no shock was administered. The animals of the two experimental groups were confined after receiving intraperitoneal injections of one of two different dosages of ethyl alcohol. The animals of the two control groups were confined after receiving volumetrically equivalent injections of water.

The assumption underlying the procedure was that alcohol reduces fear. The two experimental groups were thus exposed to the fear-evoking stimulus under conditions designed to diminish fear on an immediate and temporary basis while the control animals were exposed under sober or normally fearful conditions.

During the last phase, on the fourth and fifth days of the experimental cycle, all animals ran 60 test trials during which no electric shock was administered and escape to the black compartment was permitted. All animals ran these trials while sober. Since no shock was given the escape responses were presumably motivated by fear.

Statistical analysis of the comparisons of the groups indicates that:

1. The experimental conditions of confinement under the influence of alcohol resulted in significantly greater reduction in the strength of the escape response than did the control conditions.
2. There is no significant difference in extinction

between the control groups which received different volumes of water.

3. There is no significant difference in extinction between the high-alcohol and the low-alcohol groups.

4. The alcoholized animals showed a significantly greater tendency to move about the white compartment during confinement than did the sober animals.

5. Movement during the extinction phase is significantly related to extinction of the escape response.

The following conclusions are drawn:

1. The findings confirm the work of previous investigators in demonstrating that alcohol has fear-reducing effects.

2. The fear-reducing effects of alcohol are not limited to the temporary period of inebriation, but facilitate extinction, demonstrable in a later sober state, of previously acquired fear-motivated responses. Fear-motivated responses may be "permanently" diminished by pairing the fear-evoking stimulus with a chemically induced internal state that evokes responses incompatible with fear.

88 pages. $1.10. Mic 56-904

THE INFLUENCE OF TRAINING AND PERSONALITY CHARACTERISTICS OF THE EXAMINER ON RORSCHACH SCORES

(Publication No. 15,293)

George Harvey Kramer, Jr., Ph.D.
University of Houston, 1955

It was the purpose of this study to investigate examiner variance in the Rorschach test and to examine the effect of training and supervision. The differences among examiners were then related to rated personality variables.

Source of data. A group of 640 Rorschach records, tested by eight different interns, were secured from the files in the Psychology Department, University of Texas Medical Branch Hospitals. This group included 80 records per examiner, 40 from the first three months of the internship period and 40 records from the last three months of the internship period.

Procedure. The 640 records were put into eight examiner groups. These eight groups were then subdivided into two groups, initial and final testing periods. Each examiner had 40 records in the initial testing group and 40 records in the final testing group. For the 16 groups, means and S.D.'s were computed for each of the following factors: (1) human movement responses, (2) animal movement responses, (3) all shading responses, (4) all responses in which form alone was scored, (5) all responses in which texture was scored, (6) all responses in which both color and form were scored, with form being the dominant determinant, (7) all responses in which both form and color, or just color, was scored with the color being the primary determinant, (8) total number of responses, (9) the number of whole responses, (10) number of responses in the large areas of the blots, (11) the total number of rejections of the cards by the patients, (12) the number of responses in which multideterminants or blends were used to score responses, (13) the number of responses having x-ray, internal anatomy, and blood content, (14) number of responses having sexual content, (15) number of hostile side comments, (16) number of responses in which form was scored as the primary determinant, and (17) the number of unscored tests left in the files by each examiner during his first year of internship.

Every examiner was ranked with every other examiner on certain personality variables by two supervisors. The eight variables are: (1) hostility, (2) seductiveness, (3) cold-distant "efficiency," (4) dominance, (5) ingratiation, (6) ability to establish rapport with patients, (7) proficiency in administering and scoring the test, and (8) competency in interpreting Rorschach data.

The analysis of the data was concerned with: (1) a comparison between initial and final training periods for each examiner on the 17 Rorschach variables; (2) a comparison between the examiners on the 17 Rorschach variables; and (3) the relationship between supervisors' rankings of the examiners and both the total number of statistically significant differences between examiners on all Rorschach variables and the degree to which the examiners' records tended to change as a result of training.

Results. The type of Rorschach material each examiner was able to elicit from his patients changed from the initial to the final training period as a result of training and supervision. In the intraexaminer distributions, the variables CF, TR, W, D, Ext-F, and F changed the most, and the variables FC, M-D, k, FM, and c changed the least from the initial to the final training periods.

There were significant differences between examiners on the types of Rorschach data elicited from patients. The variables D, TR, F, Ext-F, W, k, and CF had the greatest number of significant differences among examiners. The variables TR, W, D, M-D, Ext-F, and FM changed in the direction of higher mean scores in the final period, but the variance among the examiners decreased. The general trend on most of the variables was in the direction of higher mean scores in the final period with less variability among the examiners.

Some of the changes in the interexaminer and intraexaminer distributions are related to personality characteristics of the examiners. The examiners, who are ranked by their supervisors as dominant, competent in interpretation of Rorschach material, and high in the ability to establish rapport with most patients, tended to change significantly in a positive direction in the final training period.

Conclusions. There are measurable differences in the types of Rorschach responses elicited by different examiners. These differences are susceptible to training and supervisory influences, and are associated with various aspects of the examiner's personality.

119 pages. $1.49. Mic 56-905

AN INVESTIGATION OF THE RELATIONSHIP BETWEEN CONCEPT FORMATION AND ACHIEVEMENT IN READING

(Publication No. 15,719)

Roy Alfred Kress, Jr., Ph.D.
Temple University, 1956

Statement of the Problem

The purpose of this investigation was to explore differences between severely retarded and achieving readers in ability to form concepts or to conceptualize. Specifically, between these two groups, are there

1. quantitative differences in ability to form concepts?
2. qualitative differences in ability to form concepts?
3. differences in conceptual functioning at the (a) concrete, (b) functional, (c) abstract-conceptual level?

Summary of Procedures

The following procedures were used:

1. The population comprised 25 pairs of Caucasian males between the ages of 8-0 and 11-11 of normal or above-normal intelligence, matched for chronological age, school experience, and intelligence (WISC).
2. One of each pair was a non-reader; the other, an achieving reader. Both were selected by performance on an informal word recognition and reading comprehension test, and the reading sub-tests of the Stanford Achievement Test, Elementary Battery, Form J.
3. The Personality Inventory for Children (Brown) was administered to appraise any atypical aspects in this area.
4. Six tests were administered to measure the variable under investigation.
   a. Gelb-Goldstein-Weigl-Scheerer Object Sorting Test
   b. Goldstein-Scheerer Cube Test
   c. Weigl-Goldstein-Scheerer Color-Form Sorting Test
   d. Kasanin-Hanfmann Concept Formation Test
   e. Wisconsin Card Sorting Test
   f. The Verbal Opposites sub-test of the Detroit Tests of Learning Aptitude
   g. The Similarities sub-test of the WISC
5. All tests were administered individually by the writer. The results were compiled and the null-hypothesis tested using Student's t-test, Fisher's t-test, and chi-square. Significant chi-square values were corrected for continuity.

Results

Statistically significant differences between the groups in the ability to form concepts were found in

1. Quantitative measurement.

   Non-readers:

More perseverative errors on the second sort	W.C.S.T.	< .05
Fewer unique errors on the fourth sort	W.C.S.T.	< .05
Fewer designs on the first three and first four steps	Cube	< .05
More clues and time for design 8	"	< .05
Less successful in sorting both form and color	Color-Form	< .05
More split-narrow categories, Part II	Obj. Sort.	< .02

2. Qualitative measurement.

   Non-readers:

More perseverative than non-perseverative errors on the second sort	W.C.S.T.	< .05
More non-perseverative than perseverative errors on the fifth sort	"	< .05
Sorted better for form and color on the W.C.S.T. than on the first trial of the Color-Form		< .05
When sorted first for form were less successful in passing form and color	Color-Form	< .05
More failed who patterned on first sort	"	< .05
More time for design 12 than design 11	Cube	< .05
More failed design 8 on step 1	"	< .05
More who knew or learned principle failed on the second trial	Kasanin	< .02
More who need enriched clues ultimately failed	"	< .05

   Achieving readers:

More non-perseverative than perseverative errors	W.C.S.T.	< .01

   Both groups:

A significant number of those who sorted form and color on the W.C.S.T. failed on the first trial of the Color-Form test		< .02

3. Conceptual levels.

   Non-readers:

More concrete	Similarities	< .01
More concrete plus functional	"	< .02
More concrete than abstract-conceptual	"	< .01
More syncretistic and fabulatory	Obj. Sort.	< .05

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

Less able to verbalize the principle	Kasanin	<.05
Fewer opposite concepts	Verbal Opp.	<.01
Achieving readers:		
More functional than concrete	Similarities	<.05
Both groups:		
More concrete and functional than abstract-conceptual, Part I	Obj. Sort.	<.05
More concrete than functional, Total Score	" A.R.	<.05
	N.R.	<.01
More functional than abstract-conceptual, Total Score	"	<.01

Generalizations

On concept formation tests, the performance of non-readers reflects a greater concentration of the following characteristics which appears to distinguish them from achieving readers. In approaching a new conceptual task,

1. they lack
   a. versatility and flexibility.
   b. originality in establishing suitable hypotheses for testing.
   c. initiative for exhausting all solutions.
   d. persistence in problem solving under changing conditions.
   e. ability to draw inferences from relevant clues.
   f. ability to shift set when new standards are introduced.
   g. ability to analyze the factors present.
   h. adequate labels for common concepts.
   i. adequate concepts for dealing with language—especially reading.
2. they exhibit
   a. a tendency to cling to previous acceptable solutions.
   b. an abnormal need for success and avoidance of failure.
   c. a dependence upon the physical characteristics of objects.
   d. a tendency to be more concrete and less abstract in conceptual functioning.

276 pages. $3.45. Mic 56-906

PERCEPTUAL CONTACT WITH REALITY IN SCHIZOPHRENIA

(Publication No. 15,756)

Edward Lovinger, Ph.D.
Michigan State University, 1954

This study was undertaken primarily to investigate perceptual contact with reality in schizophrenia. Three groups of subjects were employed in the study: schizophrenics in good contact with reality, schizophrenics in poor contact, and normals. They were tested in a size constancy experiment under three different distance cue conditions: maximal, minimal, and no-cue. The different cue conditions were achieved by utilizing two light-tight tunnels of fixed but different lengths. The illumination, and thus, the distance cues within the tunnels, was controlled by means of two variable transformers wired into the tunnel light circuits. Each subject was tested under all three cue conditions. The order of presentation of the three cue conditions was systematically randomized.

It was assumed that if schizophrenics in poor contact with reality were perceptually in poor contact, they would be less responsive to minimal distance cues. Hence, it was hypothesized that under experimental conditions involving minimal distance cues, schizophrenics in poor contact would manifest less size constancy than either schizophrenics in good contact or normals. The results of the investigation supported this hypothesis. The schizophrenics in poor contact manifested significantly less size constancy than either the schizophrenics in good contact or the normals. This finding was interpreted as indicating that the schizophrenic's break with reality involves not only more complex psychological functions but basic perceptual processes as well.

There were no other significant differences among the groups in the amount of constancy they manifested for any of the cue conditions. There were no significant differences between paranoid and non-paranoid schizophrenics in the amount of constancy they manifested for any of the cue conditions.

The order of presentation of cue conditions had a significant effect upon the amount of constancy. When the maximal cue condition was first, the amount of constancy for the minimal or no-cue conditions was greater than that when the testing was initiated with these cue conditions. When the minimal or no-cue conditions were first, the amount of constancy for the maximal cue condition was less than that when the maximal cue condition was first. These findings were interpreted as indicating that the initial cue condition established a set for the subjects to respond on subsequent cue conditions in the direction of the initial cue condition.

The results suggested the need for a number of studies. Investigations of perceptual contact with reality in schizophrenia in terms of shape, color, and brightness constancy as well as some of the other basic perceptual processes might prove fruitful. Furthermore, it was suggested that systematic study of the order effect might have considerable importance not only for size constancy, per se, but for perception as well.

76 pages. $1.00. Mic 56-907

AN INVESTIGATION OF THE EFFECTIVENESS OF AN ENTRANCE TEST BATTERY FOR PREDICTING SUCCESS IN LAW SCHOOL

(Publication No. 12,681)

Richard Ralph Martin, Ph.D.
Temple University, 1954

Problem: The major problem of this study was to evaluate the effectiveness of the entrance tests used at the Temple University School of Law. The main difference between this study and other reports was that it attempted to predict performance on state bar examinations. In addition, it attempted to predict law school success in terms of graduation with a test battery on which little research has been done.

Procedures: The population of this study consisted of 511 students admitted to law school in the day and evening classes of 1947, 1948, and 1949. In 1947, students were admitted to law school without the use of entrance tests. These students took the tests after entrance. In 1948 and 1949, students were admitted partly on the basis of scores on an entrance test battery. The test battery consisted of the A.C.E. Psychological Examination, the Barrett-Ryan-Schrammel English Test, the USAFI Social Studies Test (College Level), the Iowa Legal Aptitude Test, the Cooperative English Test-Reading Comprehension, and two sub-tests (Current Social Problems and History) from the Cooperative General Culture Test.

Each student in the population was classified in terms of: (1) year of entrance, (2) day or evening school, and (3) graduated, failed, withdrew, or still in school. Students were then compared for differences in performance on the entrance tests in terms of their classification; i.e., graduated vs. failed, graduated vs. withdrew, day vs. evening, and 1947 vs. 1948 and 1949 students. All differences were tested for statistical significance.

Zero-order correlations were computed for all day and evening classes between the entrance tests and: (1) first year weighted grade-point averages, (2) final graduate averages, and (3) performance on state bar examinations. From these r's, six shrunken multiple correlations were computed, three for the evening classes and three for the day classes. Regression equations were then developed for prediction purposes.

Factors that could have affected the predictive efficiency of the tests were also studied. The factors included: (1) the reliability with which law students were graded from year-to-year in their studies, (2) the mortality rate for each instructor, (3) a comparison of mortality rate between day and evening students, and (4) whether or not a difference existed in mortality rate between the 1947 and the 1948 and 1949 classes. These factors were studied in order to determine whether or not the criteria were contaminated and to determine the effectiveness of the entrance test battery in selecting law students.

Results and Conclusions: Within the limitations of this study the following conclusions with respect to the specific questions asked appeared to be warranted:

In all classes studied the graduated students were superior on the entrance tests as compared with failed students. The differences in the average abilities of graduated and failed students in the 1949 evening class were not as significant as the differences for the other classes. Nevertheless, it was concluded that the entrance tests did differentiate between the graduated and failed students.

The differences in the ability levels were not as great between the graduated and withdrew students as in the case of the previous comparisons. It was concluded, however, that the graduated students tended to perform better on the entrance tests than the withdrew students.

On the basis of total day class versus total evening class comparisons on the entrance tests, it was concluded that there were no differences in the average abilities of these students.

The 1948 and 1949 day classes were significantly superior to the 1947 day class on the entrance tests, while the evening classes showed little difference in their average abilities on the tests. It was concluded that the use of entrance tests for selection increased the ability levels of day students, but had little effect in improving the ability levels of students admitted to evening school.

The correlations of the scores on the entrance tests with first year averages for the combined day classes ranged from .23 to .48. The r's for the combined evening classes with the same criterion ranged from .20 to .44. All r's for both groups were statistically significant. Using Guilford's criterion for interpreting r's, the r's had either definite but small relationships or substantial relationships with the criterion.

Correlations of scores on the entrance tests with final graduate averages for the combined day graduates varied from .16 to .44, and all were statistically significant. The r's for the combined evening graduates varied from .21 to .64. All but two of these r's were statistically significant. It was concluded that most of the test variables had either definite but small relationships or substantial relationships with this criterion.

Statistically significant biserial r's were obtained between 14 of the 18 entrance test variables and state bar examinations for day graduates, ranging from .22 to .54. The evening graduates had only 6 of the 18 test variables statistically significant, ranging from .36 to .64. It was concluded that most of the variables had small but definite relationships or substantial relationships with this criterion for the day graduates, and the r's for the evening graduates showed substantial relationships.

The shrunken multiple-correlations for the combined day graduates were as follows: (1) 5-variable $\overline{R}_1$ with first year averages was .532; (2) 5-variable $\overline{R}_2$ with final graduate averages was .480; and (3) 4-variable $\overline{R}_3$ with state bar examinations was .539. All $\overline{R}$'s were statistically significant, and it was concluded that their relationships with the three criteria were substantial.

The $\overline{R}$'s for the combined evening classes were: (1) 5-variable $\overline{R}_1$ with first year averages was .511; (2) 6-variable $\overline{R}_2$ with final graduate averages was .763; and (3) 3-variable $\overline{R}_3$ with state bar examinations was .732. All $\overline{R}$'s were statistically significant, and it was concluded that they showed either substantial or marked relationships with the three criteria.

A study of certain factors which might have detracted from the effectiveness of the entrance tests led to the conclusions that since the grades for law school students did not show high reliability, and because three of the instructors had mortality rates that were rather high, there could have been a reduction in the size of the r's between the entrance tests and law school grades. It was also concluded that the criteria for the evening students could have been contaminated further because the mortality rate was higher among them than it was for the day students. It was finally concluded that the entrance tests were effective in selecting day students, and even though evening students did tend to show a slight decrease in mortality rate, the effectiveness of the entrance tests in their selection was indeterminable.

General Conclusions: The following general conclusions can be drawn from the results of this investigation:

1. Statistical evaluation of the effectiveness of the entrance tests showed that a revision of the original battery would make it more effective. The final battery, revised, consisted of eleven of the original eighteen test variables, including the ACE Q, ACE L, BRS English, Iowa Analogies, Reasoning, Opposites, Relevancy, Mixed Relations, Information, Cooperative Reading Vocabulary, and the Cooperative General Culture History Tests. The ACE Q and Iowa Mixed Relations could have been omitted also, since they contributed little towards prediction even though they were used in two of the regression equations.

2. Although the findings were encouraging, the ability of the entrance tests to predict more efficiently and thus reduce the mortality rate among law school students was not as great as was desired.

3. The criteria appeared to be contaminated, thus causing them to lack desired reliability. This lack of reliability could have tended to reduce the size of the correlations between the criteria and the entrance tests, and cause a decrease in the effectiveness of prediction.

207 pages. $2.59. Mic 56-908

A TECHNIQUE TO FACILITATE ACCEPTANCE AND ITS RELATIONSHIP TO INTERACTION DURING GROUP PSYCHOTHERAPY

(Publication No. 15,798)

James R. McCann, Ph.D.
Vanderbilt University, 1955

Supervisor: Professor Theodore Landsman

The purpose of this study is to evaluate a technique designed to facilitate therapeutic verbal interaction during group psychotherapy. Subjects were open ward neuropsychiatric patients in a Veterans Administration hospital. Criteria for selection of subjects helped to insure that group members would be capable of verbal interaction and that their disturbance was of a psychogenic nature. Subjects were assigned to one of four therapy groups which met for a series of fourteen tape recorded sessions. Two of these therapy groups made up the experimental group of thirteen members, while the remaining two therapy groups composed the control group of fifteen subjects.

An attempt was made to follow a modified nondirective approach in all of the group therapy sessions. The techniques and philosophy of nondirective therapy are consistent with phenomenological theory, and the rationale for the study was developed within this theoretical framework. It was assumed that members of the therapy groups were threatened in their relations with other people and would feel a need to protect their concept of self. Individuals would be on the defensive, and their verbal behavior would reflect this need to avoid personal material which would threaten disruption of the self-concept. As perceived threat was reduced in the accepting and permissive group therapy atmosphere, the need for defense would also be reduced. A technique to facilitate such perception would be expected to lead to a more personal type of interaction. This was the purpose of the experimental procedure.

Therapy groups were broken into smaller groups which met with the therapist following therapy session five through session twelve. This consisted of additional group therapy for the control subjects, while the facilitation technique was introduced to the members of the experimental group during their small group sessions. This technique involved a playback of portions of that group's earlier recorded group therapy sessions. Small group members were encouraged to listen to the playback and consider the feeling and content communicated. Following the playback members were invited to respond to the recorded group interaction.

No significant difference was found between the experimental and control groups when compared on the basis of increase in total responsiveness. However, when the terminal therapy sessions were compared with the initial sessions, the experimental group was found to have a significantly greater increase in statements of acceptance of others and also in statements related to primary problems. When compared with the experimental group, the control group was found to have a significantly greater increase in friendly discussion.

Each subject received pre- and post-therapy ratings on the ward observations section of the Multidimensional Scale for Rating Psychiatric Patients. The groups were compared on the basis of movement toward the reported norm. No significant differences were found.

It was concluded that the experimental procedure facilitated therapeutic interaction during group therapy. It was impossible to identify a sequential relationship between statements of acceptance of others and statements assumed to reflect self-acceptance. It was also concluded that therapeutic progress may be revealed by the nature of verbal interaction within the protective therapy situation before such progress is observed in more overt behavioral changes outside of the group session. Such verbal interaction may reflect changes in attitudes and feelings although the individual may continue to behave in his characteristic way.

118 pages. $1.48. Mic 56-909

THE RELATIONSHIP OF DEPENDENCY BEHAVIOR TO INTELLECTUAL PROBLEM SOLVING

(Publication No. 15,868)

Haig Kelly Naylor, Ph.D.
The Ohio State University, 1955

The objectives of this study were twofold:

1. To assess the generality of dependency behavior by attempting to predict the appearance of such behavior in an intellectual problem-solving task on the basis of responses from two projective tests, the Incomplete Sentences Blank (ISB) and a Modified Thematic Apperception Test (TAT).
2. To investigate the relationship between dependency behavior and intellectual problem-solving ability.

It was hypothesized that there would be a positive relationship between a dependency potential measure derived from the ISB and a behavioral measure obtained in the problem situation; that individuals having a high need value (NV) for academic achievement and low expectancy for success in this area (freedom of movement, FM) were more likely to utilize dependency behavior in a problem-solving task than individuals low in NV and high in FM; that dependency behavior may interfere with problem-solving efficiency, and that this would be reflected in time required for solution.

Reliable scores for 49 college subjects were derived from the projective tests for the three variables, dependency potential and NV and FM in the area of academic recognition. The ISB was scored for all three variables; the TAT for NV and FM only.

The problem-solving task was a difficult paper-and-pencil pegboard problem. Dependency behavior scores were derived by totaling the number of questions asked and self-depreciating remarks made to the examiner in a 15-minute period. A series of hints were then given, and the time required for solution was taken as a measure of problem-solving efficiency.

The results obtained failed to support the hypothesis of a positive relationship between ISB dependency potential and problem-dependency. However, taking NV and FM in academic recognition into account, trends in the predicted direction were found. A test of the significance of group differences in problem dependency scores was applied to two groups matched on high ISB dependency potential and high ISB NV, but differing in that one had low ISB FM scores and the other had high ISB FM scores. The high FM group showed significantly lower problem-dependency scores below the 5 per cent level. A tendency was also found for lower problem-dependency scores to be associated with a group having low ISB NV as compared with one having high ISB NV when the two groups were matched on high ISB dependency potential and low ISB FM. The use of TAT NV and FM scores failed to produce significant group differences in the predicted direction.

Low but significant negative correlations were found between intelligence as measured by the O S P E and problem dependency; NV was also negatively related to intelligence.

A significant positive correlation was found between problem dependency and problem time. However, intelligence was negatively correlated with problem time. To equalize the effect of intelligence on problem solution, time scores were compared between a group low on problem dependency and a group high on problem dependency which had been matched on O S P E scores. Although matching intelligence scores reduced the relationship between problem dependency and problem time, there remained a tendency for the group scoring high in problem dependency to score high on problem time as compared with a group low in problem dependency.

These results suggest that it is possible to predict on a group level the appearance of dependency behavior in an intellectual problem-solving situation if the need and expectancy of success are considered. The results are consistent with the hypothesis that dependency behavior may interfere with problem-solving efficiency.

150 pages. $1.88. Mic 56-910

THE RELATIONSHIP BETWEEN IMAGINATIVE ROLE-TAKING AND CONDITIONS OF PSYCHOLOGICAL NEED

(Publication No. 15,870)

Stanley Newman, Ph.D.
The Ohio State University, 1955

There is a great deal of confusion in the study of identification. Clarity of definition is lacking. Therefore, separate studies of the different kinds of identification behaviors are needed before an attempt can be made to relate these behaviors. This study concerns itself with one such behavior, Imaginative Role-taking, which may be defined as: Reaction of one person to another as if he were in this other person's place, experiencing his feelings and thoughts.

The present intent is to examine the relationship between Imaginative Role-taking and psychological need conditions. Specifically, it was hypothesized that Imaginative Role-taking was directly related to the discrepancy between an individual's desire to satisfy a given need and his expectancy of being able to do this. It was further hypothesized as a result of this reasoning that Imaginative Role-taking was directly related to an individual's desire to satisfy a given need and inversely related to his expectancy of being able to satisfy this given need.

Forced-choice questionnaires were developed to measure the variables of Need Value (desire to satisfy a given need) and Freedom of Movement (expectancy of being able to satisfy a given need). The variable of Imaginative Role-taking was measured by a picture test which allowed the subject to select main characters with whom he could imaginatively change roles. This variable was also measured by a name test which allowed the subject to select real and fictional people with whom he had actually changed roles imaginatively. He was then able to rate these individuals on various characteristics which were set up in terms of these need areas: Leadership, Exhibition, Academic-Intellectual, and Heterosexual. All the other measures in the experimental procedure were also set up in terms of these need areas. The various measures were administered to 52 male subjects chosen randomly from the lists of subjects who were required to take experiments.

The discrepancy hypothesis was supported slightly, with a low degree of relationships. The hypothesis

involving Need Value alone was also supported, but at a somewhat higher degree of relationship. Analysis of the data suggested that the Need Value variable was, then, the main predictor in both hypotheses because of the large amount of error in the Freedom of Movement measure. The nature of the error was basically a contamination of "expectancy of success" items with "preferences." This was particularly true of the Leadership area, which presented a disproportionately large number of hypothetical situations with which the average subject had had no previous experience. The hypothesis stating that Imaginative Role-taking was inversely related to Freedom of Movement was not clearly supported. This was believed to be explained partly by the fact that many subjects responded to Freedom of Movement items with preference responses.

The findings suggest that Imaginative Role-taking can be understood, not alone descriptively, but from an analysis of the relevant conditions underlying it. A developmental scheme was outlined for the learning of Imaginative Role-taking behavior. It was thought that an analysis of the data suggested a factor of "similarity to the subject" that operated to enhance role-taking. That is, a person will more readily fantasy-role-change with people who are much like himself. This was tested for in a post hoc procedure and supported.

A theoretical model for Imaginative Role-taking was suggested for future research. It was hypothesized that Imaginative Role-taking is a function of:

1. Degree of discrepancy between what a person wants and what he expects his positive, direct behavior will achieve for him in a given area.
2. Degree of perceived similarity between the one who is imagining and the one whose place he is taking.
3. Degree to which the other person is able to successfully satisfy the need that is frustrated in the one who is role-taking.
4. Degree to which the individual's culture accepts indirect behaviors as proper means of achieving need satisfactions.
5. Level of symbolic language development of the individual.

The present study was concerned only with factors 1 and 2, which were supported. Further research is needed to control more adequately in an experimental situation all of the factors enumerated. 129 pages. $1.61. Mic 56-911

RORSCHACH RELATIONSHIPS WITH INTELLIGENCE AMONG FAMILIAL MENTAL DEFECTIVES

(Publication No. 14,966)

Donald Potter Ogdon, Ph.D.
University of Missouri, 1955

Supervisor: Fred McKinney

Sixty familial mental defectives at the Missouri State School for the Feeble Minded and Epileptic were examined with the Rorschach and Wechsler-Bellevue Scale. These subjects were selected with regard for age, sex, race, and diagnosis. All patients had been examined by a psychiatrist, and had been legally declared feeble-minded by courts of record.

This study was addressed to the following general questions:

1. Are the purported Rorschach signs of intelligence significantly correlated with Wechsler I.Q. with this diagnostic group?
2. Are certain Rorschach personality signs related to or depressed equally with progressive degrees of mental retardation?

Rorschach signs hypothesized to vary directly with Wechsler I.Q. are: (a) form level; (b) quantity and quality of M responses; (c) quantity and quality of FM responses; (d) quantity and quality of W responses; (e) quantity of P responses; (f) content becomes less varied; (g) R, the total number of responses; and (h) total number of color responses.

Rorschach signs hypothesized to vary inversely with Wechsler I.Q. are: (a) A/Ad responses; and (b) quantity of pure C responses.

Specific hypotheses examined concerning other personality characteristics of familial mental defectives include:

1. W-M, theoretically a measure of level of aspiration, relates inversely to I.Q.
2. Form level of FC and CF responses, theoretically measures of socialized emotional control, become progressively poorer as I.Q. decreases.
3. Number of M, and number of FM considered as M potential, theoretical measures of the ability to delay the expression of feeling in order to gain control over behavior, become progressively poorer as I.Q. decreases.
4. Number of FC, theoretically a measure of control over emotional impact without loss of responsiveness, decreases as I.Q. decreases.
5. The number of Fc/cF responses, theoretically a measure of the ability to accept affection and to recognize the need for same, decreases as I.Q. decreases.

Product moment correlation coefficients were calculated to determine the degree of relationship existing, if any, between Wechsler I.Q.'s and these Rorschach signs.

With regard to hypotheses concerning the first question outlined above, eight purported Rorschach signs of intelligence correlated significantly with Wechsler I.Q. These were form levels of R, F, M, FM, W, number of P, number of content categories used, and number of pure C. Pure C tended to increase as I.Q. decreased; a positive relationship with I.Q. obtained with the others.

With regard to hypotheses concerning the second question outlined above, number of M responses did not relate significantly with I.Q., and was severely depressed throughout the mental defective range. Likewise, the W-M measure had insignificant relationship with intelligence within this range.

The Fc/cF measure was found to correlate with Wechsler I.Q. at the .01 level of confidence, and was found on the average of almost one per record.

FC responses did not correlate significantly with Wechsler I.Q. and appeared only rarely in these protocols. The form level of FC, however, correlated with I.Q. at the .01 level of confidence.

The psychological rationale and hypothesized meaning of these findings was discussed with special reference to the training and care of institutionalized defectives. Suggestions for further research were made.

42 pages. $1.00. Mic 56-912

AN ANALYSIS OF THE DYNAMICS OF LEADERSHIP IN SMALL GROUPS OF ADOLESCENTS WITH BEHAVIOR PROBLEMS

(Publication No. 15,574)

Robert Ovryn, Ph.D.
New York University, 1955

The purpose of this investigation was to discover some of the dynamics of leadership emergence in small groups of adolescents with behavior problems.

It was hypothesized that leadership emergence is a function of individuals in interaction and related to the needs of the group. It was further hypothesized that as group needs change the identity of leadership will change unless an already existing leader is able to meet the specific new needs.

To test these hypotheses, groups of four boys, initially leaderless and selected at random except for age, were involved in five separate tasks (two discussions, the second of which was loaded in favor of the most reticent discussant in the first discussion; a ranking task; a task in which the group had to blow a ping-pong ball onto a center circle on a table; a task involving group decision concerning a plaster cast and the execution of a clay model) which were designed to create different kinds of group needs.

Rankings of the leadership hierarchy in each task situation were made by the experimenter, two judges who listened to tape recordings of the sessions and by the participants. Personality assessment data were collected for each subject. A check list was used to categorize behavior as it occurred in each group task situation.

The study population consisted of sixteen boys between the ages of twelve and sixteen who attended a special school for children with behavior problems who could not adjust to an ordinary school.

Rankings of leadership hierarchies in each group made by the experimenter and judges correlated .68 with those made by subjects, although there was better agreement concerning the individual leader (first in the hierarchy) in each situation. Judgments of the experimenter and judges were used as the criterion of leadership.

One subject emerged as leader in four out of five situations; two subjects emerged as leaders in three situations; two were leaders in two situations; six subjects were leaders in one of the five situations.

Leaders showed more productive behavior (more suggestions, more opinions, more encouragement of others) and contributed more to tension release in the group. Followers asked for more orientation and guidance and showed more negative emotional behavior. Leaders were found to behave differently in different kinds of situations and in a manner specific to the requirements of each situation. Where subjects emerged as leaders in more than one situation their behavior was found to enhance group goal achievement in each situation.

No significant differences in personality characteristics were found to differentiate leaders from followers. Superior skills and interests were found to be insufficient requisites for leadership emergence except when combined with an ability to communicate to the group and to be recognized by the group.

It was concluded that leadership is a function of the ability of the individual to help the group reach a specific goal and that leadership will change in divergent kinds of situations unless a prior leader is able to provide specific leadership consistent with new group needs.

237 pages. $2.96. Mic 56-913

CHANGES IN EXPECTANCY IN SKILL AND CHANCE SITUATIONS

(Publication No. 15,877)

E. Jerry Phares, Ph.D.
The Ohio State University, 1955

The major purpose of the study was to demonstrate the effect of situational variables on expectancy changes. It was predicted that expectancies for future reinforcement would show greater changes following reinforcement in a skill situation than in a chance situation. This prediction was based on the interpretation that in a skill situation obtained scores (reinforcement) are based on performance. Therefore, the subject will utilize past performances as a basis for future expectancies. In a chance situation, on the other hand, obtained scores are not controlled by the subject, and he is thus prevented from utilizing past performances to the same degree.

In order to test this hypothesis, two experimental tasks were designed. One involved the matching of colors, and the other, the matching of lengths of lines. Four groups, totaling 77 female subjects, were used. The first group received the color task structured as chance first, and the line task second, structured as skill. The second group received the same tasks and structure but in reverse order. The third group received the line task structured as chance first and the color task structured as skill second. The fourth group received the same tasks and structure, but in reverse order. Each subject went through a series of thirteen trials on each task, and all received the same pattern of fixed reinforcement.

It was also predicted that individuals differ in the extent to which they attribute obtained reinforcements to their performance or to chance factors. A single dimension was predicted with individuals at one extreme who believe chance to be the dominant factor and individuals at the other extreme who believe their performance or behavior to be the major factor. It was believed that individuals at either extreme were likely to be maladjusted, because of their tendency to indiscriminately generalize one or the other expectancy to most situations. Thus, a curvilinear relationship was predicted between maladjustment and this dimension.

A questionnaire, designed to measure generalized expectancy for chance versus self-determination, was constructed. The measure of maladjustment was the Rotter Incomplete Sentences Blank—College Form.

A third hypothesis predicted that individuals with extreme chance scores on the questionnaire would show smaller expectancy changes on both experimental tasks than would an extreme group from the opposite end of the dimension. This latter group would show greater expectancy changes on tasks.

The major findings of the study were:

1. A chance situation does produce significantly smaller expectancy changes than a situation categorized by the subject as skill. This finding included the following

conclusions: (a) chance situations lead to smaller magnitudes of expectancy changes, exclusive of "unusual" shifts, (b) chance situations lead to smaller magnitudes of expectancy changes, including "unusual" shifts, (c) the frequency of expectancy shifts is greater in skill situations, and (d) the proportion of usual shifts to total number of shifts tended to be greater in skill situations—and, reciprocally, the proportion of unusual shifts to total number of shifts tended to be greater in chance situations.

2. A curvilinear relationship between maladjustment and scores on the chance questionnaire could not be demonstrated. Part of this failure was related to inadequacy of the measuring instrument. A slight linear relationship was evidenced when only half of the items in the questionnaire were used. These were supposedly items most clearly measuring chance expectancies.

3. A trend toward verification of the third hypothesis was shown. When only half the items of the questionnaire (chance items) were used, this trend was strengthened.

The results of the last two hypotheses were suggestive rather than conclusive and need further investigation. The first hypothesis was emphatically confirmed. Some clinical implications of these findings were discussed.

104 pages. $1.30. Mic 56-914

THE MEANING OF RORSCHACH WHITE SPACE RESPONSES

(Publication No 14,018)

Joseph Bland Ray, Ph.D.
The University of Oklahoma, 1955

This study was designed to evaluate Rorschach's assumption that white space in an extratensive experience balance reflects an "oppositional tendency." The method used to test this hypothesis was as follows: Two subject groups were differentiated according to the percentage of white space they reported on an individually administered Rorschach test. The high white space group was composed of eight subjects who gave ten percent or more of white space responses on the Rorschach. The low white space group consisted of seven subjects with five percent or less of responses determined by white space. The experience balance of both high and low white space groups was extratensive. The experimental procedure in the two autokinetic situations was identical for both groups. In the first session, each subject made fifty oral judgements of visual apparent movement alone in a completely darkened room. The second session differed from the first in that each subject made fifty oral judgments of visual apparent movement in company with an established prestige person who cooperated with the experimenter. The prestige person's judgments were arbitrarily predetermined and based on the subject's 90th percentile score in his range of "alone" judgments.

Immediately preceding the second autokinetic session the prestige person, who was introduced as an Air Force Colonel, attempted to mobilize the subject's surface or deep-seated feelings of oppositionality.

A proportional measure of change was determined for each subject, a change which was based on the subject's variability in the "alone" session. The difference between the change scores of the two groups, tested with U statistic of Mann and Whitney, was significant at the .003 level of confidence. Comparison of the change scores revealed that the high white space group had scores significantly lower than the low white space group. Conversely, the low white space group showed a significant tendency to shift judgments when in the "together" situation.

Analysis of individual median shifts from the "alone" to the "together" situation revealed that all seven of the low white space subjects changed significantly, whereas only one of the high white space subjects revealed a significant change in the direction of the prestige person's suggestion.

It was concluded that people with an extratensive experience balance who report ten percent or more of white space responses on the Rorschach test tend to manifest oppositional tendencies; conversely, people with an extratensive experience balance who report five percent or less of white space responses on the Rorschach tend to exhibit little if any oppositional behavior.

These results were interpreted as substantiating Rorschach's assumption that white space in an extratensive experience setting reflects an "oppositional tendency."

84 pages. $1.05. Mic 56-915

CORRELATES OF ATTITUDES AMONG CLINICAL PSYCHOLOGY STUDENTS

(Publication No. 15,749)

Sheldon Rosenthal, Ph.D.
Columbia University, 1955

The general question of what underlies the psychological orientation of clinical psychology students was approached in the present study by attempting to relate several variables to Shaffer's Objective-Intuitive scale. A seven page blank was developed and eleven Universities were invited to cooperate by asking their clinical psychology students to fill out the questionnaire anonymously. Several hypotheses were formulated involving the relationship of the variables measured in the blank with the Objective-Intuitive scale. Nine Universities responded in time to be included in the main study, and a total of 291 completed blanks were returned.

The blank contained material in the following order: questions relating to biographical data; a shortened form of Eysenck's Radicalism-conservatism and Tough-tender minded factors; the Restraint and Masculinity scales from the Guilford-Zimmerman Temperament Survey; Thorndike's Helping, Psychometric (Measurement), and Experimenting activity preference clusters arranged as paired comparisons; multiple choice questions relating to the profession and work of the most influential or significant person in the respondent's training; a list of adjectives from which a respondent could check the attributes he feels are possessed by the most influential person; a multiple choice question relating to the reasons for the respondent originally choosing to associate with the preferred significant figure; and Shaffer's Objective-Intuitive scale.

Some of the hypotheses tested were substantiated and others were not. Masculinity was found to be slightly

related to the objective end of the objective-intuitive scale. Helping activity preferences were related to intuitive attitudes and Experimenting preferences to objective attitudes as hypothesized, but Measurement preferences, contrary to expectations, were related to intuitive rather than objective orientation. Restraint, Tough-tender mindedness, Radicalism-conservatism, and year level in the clinical program appeared unrelated to objective or intuitive attitudes.

Highly significant relationships were obtained between psychological orientation and the descriptions, profession, and work of the influential person in the respondent's training. Intuitive students were apparently influenced most by Clinical Psychologists and Psychiatrists whose main work was devoted to Practice, and objective students preferred Other Psychologists whose main work consisted of Research and Teaching. The former group of students also chose to describe their influential figure with significantly more "warm" adjectives, and the latter group with significantly more "cool" adjectives. With considerable reservation, because of certain assumptions made, it was further found that students with strong objective or intuitive attitudes selected their significant person more on the basis of their own needs than for other considerations.

Subsidiary findings included a slight relationship between Restraint and the following: conservatism, the Helping end of the Measurement-Helping preference scale, and the profession and work of the influential person. Masculinity was also found to relate to the Experimental end of the Experimenting-Helping and the Experimenting-Measurement scales. Sex, internship status, and reasons for selecting the significant person were found not to be factors which differentiated students as to psychological orientation.

A comparison of the Universities participating in the study revealed considerable differences among them on many variables. Geographical considerations seemed not to be a factor except in the Radicalism-conservatism continuum where the two cooperating Universities from the East ranked among the highest in Radicalism. The psychological orientation of graduates and students compared by Universities correspond at either extreme but seemed not to have much similarity in the intermediate distribution. A comparison of temperament traits suggested that clinical psychology students are slightly more restrained and slightly more masculine than the Guilford-Zimmerman standardization group.

It was concluded that the psychological orientation of clinical psychology students is a complicated phenomenon that has its roots in many factors. The possibility was suggested that some students may enter the clinical program with preconceived orientations in the form of a set, and others might enter with a relatively open mind and be therefore more susceptible to influence.

79 pages. $1.00. Mic 56-916

PREDICTION OF EMOTIONAL CONTROL IN CHILDREN WITH THE RORSCHACH TEST

(Publication No. 15,800)

Charles Spital, Ph.D.
Vanderbilt University, 1955

Supervisor: Professor Arthur Canter

In spite of the tremendous amount of published work on the Rorschach test, there is still no clear evidence that this instrument is valid for the prediction of specific kinds of behavior. A number of Rorschach authorities have suggested that the test cannot be expected to predict behavior in an objective fashion; that only a subjective, Gestalt type of analysis can be fruitful.

The purpose of this study was to determine whether the Rorschach test could be used objectively to predict the emotional control of children. Forty-one occupants of a residential hospital for emotionally-disturbed children were employed as subjects of the experiment. Of this group, 31 were boys, 10 were girls, and all were between the ages of eight and twelve. They were each given a Rorschach test. A composite score was derived in each case from a number of signs and patterns. The children were also rated on degree of emotional control by staff members who were in daily contact with them.

On the basis of Rorschach and psychoanalytic theory, the following hypotheses were made:

1. A group of children who, on the basis of ratings, have been differentiated in terms of degree of emotional control will show parallel differences in terms of patterns of Rorschach signs.

2-A. Children who exhibit the following pattern on the Rorschach will tend to possess less-than-average emotional control:

No color or 1 CF or 1 C
M, O or 1
F plus, less than 60%
Fire content

2-B. Children who exhibit the following pattern on the Rorschach will tend to possess less-than-average emotional control:

FC : (CF plus C), less than 1 : 1
M, O or 1

2-C. Children who exhibit the following ratio on the Rorschach will tend to possess less-than-average emotional control:

FC : (CF plus C), less than 1 : 1

2-D. Children who respond with one or more CF minus responses on the Rorschach will tend to possess less-than-average control.

2-E. Children who exhibit the following pattern on the Rorschach will tend to possess more-than-average emotional control:

No color or 1 FC
F plus, greater than 60%
Reaction time (average) greater than four seconds.

The hypotheses were evaluated through use of the chi square test of independence. The first hypothesis was supported by the results which demonstrated in a statistically significant fashion (.05 level) that rated emotional control is related to emotional control inferred from a group of Rorschach signs. Although the secondary

hypotheses lacked statistically significant support, they are qualitatively of some value and interest.

While it is true that a sign list can adequately differentiate a group of children in regard to emotional control, it must be admitted that this procedure is not particularly effective in making predictions of the behavior of an individual child. An analysis of the results indicates that the behavior of children who give color responses on the Rorschach is predictable to a satisfactory degree, while the behavior of others who do not show responses to color is difficult to predict.

Of importance is the suggestion that the purported Rorschach measures of ego strengths and defenses of children are not important factors in predicting how well they are able to control their feelings and actions. With this group of children, little beside the color factors contributed to the prediction of emotional control. It may well be that other measures derived from the Rorschach, factors more appropriate with children, will eventually be found to be related to these ego strengths and defenses.

The group of disturbed children was compared with a group of normal children (Ames) in their reactions to the Rorschach test. There was also an investigation of the contribution of three personality factors to response to the Rorschach. The most important conclusions derived from the latter analyses are: (a) that F plus % is the only factor, among those examined, whose theoretical rationale appears to be supported by the comparison of the two groups; (b) that intelligence is probably not related to emotional control (at least with the homogeneous group of disturbed children); (c) that sex differences on the Rorschach are negligible insofar as the measures considered are concerned.

Indications of future avenues for related research were given. 82 pages. $1.03. Mic 56-917

AN EXPERIMENTAL INVESTIGATION OF PROJECTION AS A FUNCTION OF PSYCHOLOGICAL DISTANCE BETWEEN SUBJECT AND PICTURE

(Publication No. 14,435)

Lois B. Wexner, Ph.D.
Purdue University, 1955

Major Professor: E. Weisskopf-Joelson

This study was designed to investigate the following problems: (1) Whether men and women respond to pictures containing a central figure of the same sex with the same amount of projection as to identical pictures containing a central figure of the opposite sex. (2) Whether men and women give more projection to pictures of situations which are more familiar and interesting to members of the same sex than to those more familiar and interesting to the opposite sex. In addition, a comparison was made to determine whether a greater amount of projection is given by men or women.

The subjects were 30 male students at Purdue University, between the ages of 25 and 30, and their wives. A series of 20 pictures, which included four pictures each from five general areas of living, was developed for this project. Pictures in each area showed one "male" situation, one "female" situation, and two identical "neutral" situations. In the first two pictures described, the figures were "neutral," and in the last two, one contained a female figure and the other a male. The standard Murray instructions for administering the Thematic Apperception Test were used, and the pictures were administered individually in two sessions, with an interval of one to seven days between sessions.

Projection was measured by the Weisskopf Transcendence Index, an objective means to determine the number of comments about the picture which go beyond pure description.

There was no significant difference in amount of projection given either by men or women to pictures containing male and female figures. The male subjects gave significantly more projection to "male" situations than to "female" situations. The female subjects also tended to project more on "male" situations, although this did not reach a significant level. There was no difference in amount of projection given by men and women.

The findings were discussed and suggestions made for further research. 77 pages. $1.00. Mic 56-918

PSYCHOLOGY, EXPERIMENTAL

RATE AND ACCURACY OF SERIAL MOTOR PERFORMANCE AS A FUNCTION OF THE UNCERTAINTY AND THE MEAN SQUARE VALUE OF THE STIMULUS

(Publication No. 15,824)

Richard Louis Deininger, Ph.D.
The Ohio State University, 1955

Three experiments were completed which investigated the effects of the number of alternative stimuli and their separation on the rate and accuracy of serial-motor performance. Only the case in which the stimuli appeared equally often and were equally spaced along a horizontal line was studied. Throughout the experiments, the task was the same: the subject moved a stylus as quickly as possible to the strip of alternative responses while aiming for the mid-line scribed in the particular response area directly below the signal illuminated. The apparatus provided 16 combinations of 3, 8, 12, or 18 signal lights (which appeared singly) with .264", .395", .598", or 1.68" separation between the mid-points of adjacent response areas.

Task complexity was measured by the uncertainty of the signal lights, which in this instance was the logarithm to the base two of 3, 8, 12, or 18 alternatives. Because the stimuli were parametric in nature, the mean square of the signals was used to combine both the number of alternatives and their separation into a single value. A linearly increasing relation between response time and the logarithm of the signal mean-square value was hypothesized. Three predictions based on the hypothesis were tested.

The first prediction, that the number of alternative stimuli and their separation should interact in determining the response time, was confirmed by an analysis of

variance from the first experiment. (In the first study, six well-practiced subjects served in all 16 conditions for five practice sessions and four test sessions.)

The same data were used in a regression analysis to test the second prediction, which stated that the response time would increase linearly as the logarithm of the stimulus or signal mean square increased. Although the data suggest a curvilinear relation, the deviations from linearity were not significant. However, the design of the third experiment reduced the error term in the regression analysis and the curvilinearity was significant. (The third experiment took intensive measurements on three subjects, two of whom served in the first experiment.)

The third prediction was that the response time should be the same for conditions having different numbers of alternative signals and separations so long as the signal mean-square values were all equal. In the first experiment the response times for the four conditions with equal signal mean square deviated considerably from one another. The third study included two equal mean-square conditions. With two of the three subjects there was no difference between the mean response times for the two conditions. The most direct approach to this prediction was the second experiment in which twelve naïve subjects served in three different four-by-four Latin squares. The differences between the four conditions with equal signal mean-square value (which were the treatments) proved insignificant.

The accuracy of performance was measured by the information transmitted and was influenced far more by the number of alternatives than by the separation between them. The increase was progressive, though not consistent, as both variables increased.

The rate of information transmitted behaved differently, for there was an optimum separation (.598") for any given number of alternatives. The maximum rate of transmission occurred with 18 alternative signals, each separated by .598", and was 394 bits per minute (6.56 bits/second).

The conditional response distributions were not normally distributed, but rather appeared skewed, particularly for the extreme alternatives. Also, there was substantial evidence that the individual response times were loginormally distributed. 141 pages. $1.76. Mic 56-919

THE USE OF A FORCED-CHOICE SELF-RATING METHOD IN THE PREDICTION OF COLLEGE ACHIEVEMENT

(Publication No. 15,843)

Gordon Henry Henley, Ph.D.
The Ohio State University, 1955

The study was designed to develop a forced-choice self-rating questionnaire to measure the nonintellectual factors in college achievement and to predict college achievement when combined with the Ohio State University Psychological Examination (O.S.P.E.), which was assumed to be a measure of the intellectual factors.

The method which has generally been used in developing forced-choice rating scales was used as a frame of reference for the method of the present study, but some modifications were introduced because of the self-rating character of the instrument being developed. Sixty-eight students wrote biographical case studies of one highly motivated student and one poorly motivated student whom they knew. From these case studies 275 statements and phrases were extracted, and these were rated by a sample of college students on a five-point rating-scale in terms of the applicability of the statements to themselves. These ratings were then correlated with the O. S. P. E. percentile ranks and the cumulative point-hour averages of the sample of student raters. A discrimination index was obtained for each of the statements by partialling out the O. S. P. E. A preference index was obtained for each of the statements by determining the mean value assigned to each one on the five-point rating scale.

These statements were then organized into 52 forced-choice items. Each of these items contained one valid discriminating statement, along with three invalid statements, but all four were of equal preference value. The forced-choice self-rating questionnaire was scored plus one for each of the forced-choice items within which the student rater selected the valid statement. On the cross-validation sample the total score thus obtained for each student rater was correlated with the O. S. P. E. and with the cumulative point-hour average. The questionnaire total score was found to increase the prediction of the cumulative point-hour average to a slight, but significant, degree.

An item analysis was done on each of the 52 forced-choice items. Using as the criterion for a desirable item the item's high positive correlation with the cumulative point-hour average and low or negative correlation with the O. S. P. E., the investigator found that 9 of the 52 items were significant predictors, several of the others being in the direction of significance.

It was concluded that the forced-choice self-rating questionnaire developed in this study had some potential as a supplement to the O. S. P. E. as a predictor of college achievement and also as a controller of bias in self-rating instruments for measuring the nonintellectual factors in academic achievement. 131 pages. $1.64. Mic 56-920

A QUANTITATIVE STUDY OF PURSUIT PEGBOARDS

(Publication No. 15,718)

James Clifford Hirst, Ph.D.
Temple University, 1955

The purpose of this study was to design, construct, and subject to experimental study a new-type pegboard test. The problem undertaken was that of introducing and studying the role of the "motion-factor" in pursuit pegboard performance. It was necessary to design and construct two forms of new-type pegboards, namely the Hirst Pursuit Pegboards, Forms A and B, in order to explore this problem.

Pilot studies conducted by the writer indicated that critical study and evaluation of the Hirst Pursuit Pegboards as applied to a female population would raise the following specific problems:

1. Can pursuit pegboards be designed and constructed to meet the requirements of a satisfactory measuring instrument in terms of useability?

2. What is the reliability of the Hirst Pursuit Pegboards?

3. Do Hirst Pursuit Pegboards as measuring instruments of sensory-motor traits have any advantage over measurement by conventional still-type pegboards in terms of test validity?

4. Does the type of motion introduced into the pegboard task affect the validity of the tests?

5. What is the relationship between performance on still-type pegboards and pursuit pegboards?

6. What is the extent of the relationship between two different types of pursuit pegboard motion (curvilinear and rectilinear or straight line motion) in a horizontal plane, in terms of performance?

7. What is the relationship between performance on the Hirst Pursuit Pegboards and other measures, such as:

   a. Near point acuity
   b. Lateral and vertical phoria
   c. Stereoscopic vision
   d. Intelligence

For many years, tests of sensory-motor abilities have proved to be valuable instruments as aids in the selection and placement of workers and trainees in many industrial job operations. A number of pegboard tests have proved to be of great value to the personnel worker by helping him choose applicants requiring high degrees of aptitude and skill in traits such as finger steadiness, finger dexterity, and rate of manipulation. Tests such as the Purdue Pegboard Test, the Purdue Grooved Pegboard, The O'Connor Finger and Tweezer Dexterity Tests, and the Minnesota Rate of Manipulation Test have been widely used.

However, observation and pilot research studies conducted by the writer, prompted the hypothesis that the conventional pegboard tests were not as universally applicable as had been assumed. It was noted that there were many industrial tasks which required the workers to engage in pursuit performance. Jobs such as hosiery looping, seaming, and finishing were observed as typical industrial tasks which incorporated the motion factor or pursuit performance. Despite the fact that the motion factor or pursuit performance appeared to be a major variable in these tasks, the conventional or still-type pegboards were being used to select applicants for these jobs.

The hypothesis was formulated that pegboards incorporating the motion factor or pursuit performance would produce a job sample test more closely approximating the actual job operation. A review of the literature of applied psychology and human engineering revealed no experimental work with pegboards of the type designed, built, and investigated in this study. The introduction of the motion factor into pegboard design appeared to be a new or original approach to the measurement of certain sensory-motor traits. Therefore, the development and experimental evaluation of the Hirst Pursuit Pegboards appeared justifiable upon the afore-mentioned grounds.

Two new-type pegboards, The Hirst Pursuit Pegboards, Form A (curvilinear motion) and Form B (rectilinear motion) were designed and constructed for use in the study. In addition to the Hirst Pursuit Pegboards, five other instruments were employed in the study. These instruments were: 1) The O'Connor Finger Dexterity Test, 2) The Purdue Pegboard (right-hand peg insertion), 3) The Bausch and Lomb Ortho-rater, 4) The Wirt Stereo-Test, and 5) The Otis Self Administering Test of Mental Ability. With the exception of the Ortho-rater tests, all tests were administered by the investigator. Four trial scores (Forms A and B of the Hirst Pursuit Pegboards) were obtained from the college sample and the hosiery seamers received three trial administrations on each of the Pegboard Tests (the Hirst, the O'Connor, and the Purdue).

Two populations were used to obtain data for this study. 1) A sample of 100 college students (females) was used to determine the reliability of the new-type pegboards, 2) A sample of 60 full-fashioned hosiery seamers was employed in the validation study.

Three criteria of job proficiency were developed as follows: 1) a production index, 2) a supervisor's rating index, and 3) a combined criterion utilizing both production and supervisors' ratings scores.

In order to determine the relationships between the variables used, the Pearson Product-Moment Correlation Technique and Multiple Correlation Method were used. Test reliability was estimated by the test-retest and split-half methods. The pegboard tests were rotated to minimize practice effects and analysis of variance was employed to determine the extent of practice effects.

The results obtained within the limitations of this study appear to justify the following conclusions:

1. The two newly developed Hirst Pursuit Pegboards have met the requirements of a satisfactory measuring instrument in terms of useability i.e., time required for administration, ease of scoring, and range of application to the practical problems of industrial selection and placement. However, the initial cost of the Hirst Pursuit Pegboards is considerably higher than that of the conventional pegboards.

2. The reliability of the Hirst Pursuit Pegboards (.84 corrected by the Spearman Brown Formula) was as high as the reliabilities of several other tests widely used in industrial selection and placement programs.

3. The validities of the Hirst Pursuit Pegboards were comparable to the validities of the conventional still-type pegboards, when a group of 60 hosiery seamers was studied.

4. The type of motion (curvilinear vs. rectilinear) introduced into the Hirst Pursuit Pegboard task did not measurably affect the validity of the tests.

5. The relationship between performance on the still-type and the pursuit pegboards was low and insignificant with the exception of a moderately positive correlation between two sub-tests of Form A (curvilinear motion) of the Hirst Pursuit tests and the two conventional pegboards.

6. The relationship between two different types of pegboard motion (curvilinear and rectilinear) in terms of performance was very low and statistically significant only for the large pegs.

7. The relationships between performance on the Hirst Pursuit Pegboards and Ortho-rater near-point visual measures range from very low and statistically insignificant to moderately positive relationships.

The items following each abstract are: the number of manuscript pages in the dissertation, its cost on microfilm, and the Library of Congress card number. Enlargements 5-1/2 x 8-1/2 inches, 10 cents per page. No postage is charged if check or money order accompanies order.

a. Near-point visual acuity of both eyes showed no relationship to the Hirst Pursuit Pegboard performance.

b. Near-point visual acuity of the right eye showed no relationship to the Hirst Pursuit Pegboard performance.

c. Near-point visual acuity of the left eye showed a moderately positive relationship to the Hirst Pursuit Pegboard performance (Form B, Rectilinear).

d. Lateral phoria showed no relationship to the Hirst Pursuit Pegboard performance.

e. Near-point stereopsis showed a low positive relationship to the Hirst Pursuit Pegboard performance (Form A, Curvilinear).

f. The relationship between the Hirst Pursuit Pegboard performance and intelligence as measured by a group test was low positive and statistically insignificant.

This investigation suggests that further studies of the Hirst Pursuit Pegboards should be conducted on a variety of job operations that involve pursuit tasks. Furthermore, more experimental studies should be undertaken to determine the relationship between the Hirst Pursuit Pegboards and other measures of sensory-motor performance.

142 pages. $1.78. Mic 56-921

AN INVESTIGATION OF THE PERFORMANCE OF THE HUMAN MONITOR

(Publication No. 15,845)

Daniel Howland, Ph.D.
The Ohio State University, 1955

An investigation of the performance of the human in a monitoring situation was conducted. Subjects were required to detect and report 14 randomly spaced changes in the mean of a continuous process of known mean and standard deviation during a four-hour experimental period. The frequency of Type I errors, reporting a shift when there was none, and of Type II errors, failing to report a shift when it occurred, was recorded, as well as the time lag in correctly reporting a shift.

Two groups of paid subjects were used. Each group was made up of twelve persons. One group maintained a written record of the readings of four voltmeters. The readings presented random values from a normal population with a mean of 12 volts and a standard deviation of 2 volts. The other group maintained no written record. At randomly determined time intervals, the mean of the distribution was shifted 1.5 standard deviations plus or minus. Subjects reported when these shifts occurred by pressing a toggle switch.

The general findings were:

1. The decrement in performance reported by some other investigators of vigilance over long-time intervals was not observed.

2. Only 30 shifts were missed out of a total of 336 presented to both groups. The group which maintained the log missed significantly more shifts than the group which did not, although it operated at a significantly higher confidence level when reporting shifts.

3. The group with no written record made significantly more Type I errors (reporting a shift when there was none), and reported shifts when they did occur with a significantly smaller time lag, than the group which maintained the written record.

4. The probability level that a shift had occurred when it was correctly reported was high for both groups, but significantly higher for the group which maintained the log.

5. Subjects were not able to describe the decision rules used in detecting shifts in the process mean. No standard sampling plan appeared to fit the data. The results indicate that several types of cues were utilized on reaching a decision.

6. The ability of the human to use a complex decision model may be the main advantage of using him as a monitor in a complex man-machine system, as long as a general performance decrement can be avoided.

66 pages. $1.00. Mic 56-922

AN EXPERIMENTAL INVESTIGATION OF STIMULUS INTENSITY AS RELATED TO PERFORMANCE AND LEARNING

(Publication No. 15,655)

Keith Wellsley Johnsgard, Ph.D.
State College of Washington, 1955

This investigation was designed to determine the relationships between stimulus intensity and performance, and stimulus intensity and learning.

Five groups, each comprised of 20 albino rats, were trained to run down a 24 inch long elevated runway to a stimulus card. Each group responded to one of five 4-inch square cards with luminances of 0.09, 0.54, 1.27, 2.04, and 3.01 millilamberts. The cards were presented before a large screen with a luminance of 1.70 millilamberts. Individual animals received a total of 100 distributed reinforced trials over a period of 10 days. Group acquisition latencies were recorded daily, and the reciprocals were employed to plot five curves. The asymptotes of these fitted curves were plotted as a function of stimulus intensity.

Each training group was then subdivided into five groups of 4 animals. Each of these sub-groups was then extinguished on one of the five stimulus intensities. A record was made of the total number of responses to extinction, and the total number of responses during the first 60 seconds of extinction for each of the 25 groups. These data were then entered into a five by five matrix with rows representing acquisition intensities, and columns representing extinction intensities. In applying a complex analysis of variance test it was assumed that significant column variation would reflect performance differences, and significant row variation would reflect learning differences. These differences would presumably be caused by the effect of stimulus intensity per se (stimulus-intensity dynamism). The hypotheses tested were:

1. Stimulus intensity dynamism operates in terms of

contrast between stimulus and background, rather than in terms of absolute physical intensity.

2. Stimulus intensity dynamism defined in terms of contrast has a positive effect on the strength of response (performance).

3. Stimulus intensity dynamism as defined in terms of contrast does not affect the strength of conditioning (learning).

The results and conclusions were as follows:

1. Response strength as measured by speed of running and by two extinction criteria was found to be positively related to increasing stimulus contrast, thus supporting hypotheses one and two.

2. Strength of conditioning as measured by the total number of responses to extinction criterion was found to be related to a decrease in absolute stimulus intensity. The total number of extinction responses in sixty seconds showed no relationship. Thus, one criterion rejects hypothesis three, and a second supports it. Rationale for placing more emphasis on the sixty-second criterion were discussed.

3. The possibility was discussed that the dynamism observed could be explained as an interaction of the goal gradient and stimulus generalization, thus eliminating the necessity of postulating stimulus-intensity dynamism as a separate construct in accounting for the results.

4. The five stimulus generalization gradients generated by the acquisition groups were all roughly U-shaped, regardless of where the animals were trained. It was noted that these gradients differed considerably from the stimulus generalization gradients commonly reported.

47 pages. $1.00. Mic 56-923

TWO EXPERIMENTS ON THE INHIBITION OF THE DRINKING RESPONSE OF THE ALBINO RAT

(Publication No. 15,903)

Arthur Kahn, Ph.D.
Indiana University, 1952

Experiment I

The experiment was conducted to explore the effects of the "prefrontal lobotomy" operation on the inhibition of the drinking response of the albino rat in a Skinner box-type apparatus.

Thirty-four albino rats were trained to press a bar to obtain water in Skinner-type apparatus after a 23 hour water deprivation period. After a pre-determined number of bar pressing and drinking responses had been made by the animals, they were shocked through the mouth when they attempted to drink. The inhibition was considered established in an individual animal if that animal did not attempt to drink on the twentieth day of the experimental procedure. On this day the animals were randomly assigned to one of four groups. Eleven animals were assigned to the experimental group; seven, to the operated control group; eight, to the sham operated control group; and eight to the non-operated control group. The brains of the experimental animals were damaged near the frontal poles. The brains of the animals in the operated control group were damaged about midway along the longitudinal axis of the brain. The rats of the sham-operated control groups were anesthetized and a medial incision made in the skin of the scalp followed by a small amount of drilling of the skull. The animals of non-operated control group were not subjected to any surgical treatment. Seven days later all animals were tested for retention of the inhibition.

The following results were obtained:

1. The inhibition established in the animals of the non-operated control group dissipated in time.

2. The animals in the operated groups maintained a small number of bar presses and bar presses followed by drinking responses during the test period.

On the basis of these results it is concluded that it was not possible to determine the effect of any of the operative procedures on the bar pressing response or the bar pressing response followed by drinking responses.

The discussion considers the possibilities that could account for the fact that none of the animals in any of the operated groups made a significant number of responses.

Experiment II

The experiment was conducted to determine whether restraint of the animal is a sufficient condition for the formation of the inhibition of the drinking response of the albino rat in a Skinner box-type apparatus.

Fifteen albino rats were trained to press a bar to obtain water in a Skinner box-type apparatus after a 23 hour water deprivation period. The animals were divided into two groups. The seven rats of one group, called the "masked" group were trained to drink with a mask around the dipper aperture. The mask served to restrain the animal momentarily at the dipper. The eight animals of the other group called the non-masked group were trained without the mask around the aperture. When the animals had made a predetermined number of bar pressing and drinking responses, they were shocked through the mouth when they attempted to drink. The inhibition was considered established in an individual animal if the animal did not attempt to drink the twentieth day of the experimental procedure. At the conclusion of the training period, a period of seven days elapsed before all animals were tested for retention of the inhibition. There was no significant difference between the mean number of bar presses or bar presses followed by drinking responses made by the two groups during this test period. Therefore restraint as defined operationally in this experiment is not a sufficient condition for the formation and retention as the inhibition of the drinking response as defined in this study. The results are discussed in terms of a secondary reinforcement theory.

87 pages. $1.09. Mic 56-924

VERBALIZATION AS A FACTOR IN VERBAL VERSUS MOTOR RESPONSES TO VISUAL STIMULI

(Publication No. 15,864)

Paul Ferdinand Muller, Jr., Ph.D.
The Ohio State University, 1955

The intervening processes which take place in the human between the reception of a stimulus and the execution of a response are of great interest to the theoretical

psychologist. Certain inferences have been made about these internal stimulus–response (S-R) connections, but these inferences have by no means settled the questions which have been asked. It is generally assumed that the human makes use of a process of association in making responses, and it seems logical to hypothesize that these associations depend on some sort of scheme or system for classifying the received stimuli. For the purposes of this experiment it was hypothesized that the process of verbalization might be used as such a system and, therefore, that training under conditions which forced verbalization should give differential results other than those of training which did not. It was predicted that performance under such differential conditions would be affected, and that differential pretraining with a verbal response and a motor response would have differential transfer effects. It was also predicted that S-R pairings which were hypothesized to be compatible would give superior performance to those which were hypothesized to be not compatible. That is, those stimuli requiring verbalization should profit from the use of a verbal response rather than a motor response. Conversely, those stimuli not requiring verbalization should profit from the use of a motor response rather than a verbal response.

The two types of stimuli used were (a) ten patches of color that appeared successively at the center of the display, and (b) ten ruby lights positioned to conform with the natural placement of the ten fingertips. Responses were by (a) verbal call-off of numbers, and (b) pressing ten finger keys positioned as were the ten ruby lights. A Serial Discrimeter apparatus was used to present sequences of stimuli and to record responses automatically on a matrix of electromechanical counters. Colors were presented by means of a ten-barrel optical projector behind a milk-glass screen; position lights were presented on a metal panel. Ninety-six female students drawn from undergraduate classes were used as observers (O's). The design was that of a transfer of training experiment with four experimental groups and four control groups. Scores taken were average reaction time per stimulus and average information transmitted per second (bits per sec.).

On the basis of the training scores alone, the combination of color stimuli–verbal response gave the same performance as the color stimuli–motor response, but the combination of position stimuli–motor response proved superior to the combination of position stimuli–verbal response.

Differential amounts of transfer of training were found for both types of stimuli and both types of response as a function of the type of response pretraining (verbal or motor) which was given. Those experimental groups which had pretrained on the verbal response showed higher degrees of positive transfer than did those which had pretrained on the motor response, regardless of type of stimulus.

The differences cited above were found in both reaction-time and information-transmitted scores, and proved to be significant in enough cases to allow certain conclusions.

Verbalization appeared to be a factor which caused less information transfer per second and greater reaction time per stimulus. However, the presence of verbalization in pretraining led to a higher degree of positive transfer than did its absence. It is hypothesized that this difference resulted from a greater response generalization obtained from the use of the verbalization process.

66 pages. $1.00. Mic 56-925

FREQUENCY ANALYSIS OF HUMAN MOTOR RESPONSES TO AUDITORY PITCH

(Publication No.15,728)

Ralph William Queal, Jr., Ph.D.
Washington University, 1955

Chairman: Dr. George L. Kreezer

In order to maximize the performance of man-machine systems, it is necessary to design the machine component of such a system in such a way as to take advantage of the unique capabilities of human operators and to avoid design features which might detract from system performance because of certain human operator limitations. The specification of human operator information is the concern of a broad field known as Human Engineering. Human Engineers have difficulty in expressing information about the human operator in a form which can be used by the design engineer. This study is concerned with the determination of the tracking ability of human operators responding to auditory pitch inputs, and with the applicability of a particular method of analysis known as decible-log frequency analysis. The use of such an analysis will enable the tracking ability of human operators to be expressed in exactly the same terms used by the design engineer in specifying the performance of the machine component of a man-machine system.

The specific objectives of the present investigation are two-fold: 1. To determine the capacity of human operators, incorporated in a feedback system, to respond to auditory pitch as an input signal, when the system is acting as a follow-up device, and when the system is acting as a regulating device. 2. To describe and present the response properties of the human operator, as specified above, in the form of decible-log frequency diagrams.

A series of frequency response curves were plotted which represent the ability of the operator used to perform pursuit and compensatory auditory tracking. An examination of the frequency diagrams revealed that (1) the forms of the curves for pursuit and compensatory tracking were different, (2) responses to higher input frequencies were obtained in pursuit tracking than were obtained in compensatory tracking, and (3) there were obvious inter-trial differences in both tracking situations.

In a discussion of the applicability of the method used, an interpretation of the results was attempted. It was postulated that perhaps the operators used would perform more accurately in pursuit tracking tasks, when using auditory pitch as an input, than compensatory tracking tasks. The inter-trial differences were postulated as evidences of system non-linearity. However, it was pointed out that the method enabled an examination of the limits of linearity to be made. Further, the implications of multi-mode response, evident when considering both types of tracking and the entire input frequency range, could mean that a mathematical representation of the human operator should contain both linear and non-linear components. However, it was felt it would be premature to express the response curves as transfer functions, in view of the methodological difficulties encountered in this investigation. These difficulties were related to the instrumentation used in the investigation, with special reference to the problem of obtaining accurate phase measurements.

Suggestions were made for the solution of this latter problem for use in future research.

115 pages. $1.44. Mic 56-926

FOVEAL BRIGHTNESS DISCRIMINATION AS A FUNCTION OF THE RELATIVE POSITIONS OF TEST AND ADAPTING FIELDS

(Publication No. 15,890)

Edward Allan Stark, Ph.D.
The Ohio State University, 1955

The problem: The experiment was designed to investigate the relationship between the differential threshold for a test area of illumination and the position of that test area on an adapting field four times its size.

Procedure: Differential threshold measures were made of two test fields 1.5° and 0.25° in diameter which were placed concentric to their respective adapting fields and in three positions progressively nearer the edge of the dark area outside the adapting fields.

Results: Data collected on three subjects indicate that as the test field is moved from the center of adapting illumination the sensitivity of the eye to the test field diminishes.

Conclusions: The nature of interaction within the visual mechanism is such that the sensitivity of the mechanism for difference thresholds is increased by placing the test stimulus near the center of adapting activity. Sensitivity is decreased when the test stimulus appears away from the center of activity. 36 pages. $1.00. Mic 56-927

RELIGION

CRITERIA FOR THE INTENTIONAL COMMUNITY: A STUDY OF THE FACTORS AFFECTING SUCCESS AND FAILURE IN THE PLANNED, PURPOSEFUL, COOPERATIVE COMMUNITY

(Publication No. 15,568)

Wendell Barlow Kramer, Ph.D.
New York University, 1955

The material covered in the dissertation includes a statement of the problem, setting, and need for the study; an historical account of representative communities covering the entire range of North American intentional communities of the past; case studies of approximately seventy-five percent of the present existing intentional communities within the United States and Canada as to history, fundamental characteristics, and basic principles underlying their purposes and practices; a detailed study of the factors related to success and failure of such communities; the construction of a guide for measuring the potential of any specific intentional community as to probable success; and selected conclusions and recommendations as to possible application and use of the findings.

The methods used in securing the data were of four types. They were the study of the literature of an historical nature, questionnaire studies securing individual responses from a large sampling of intentional community members, personal visitation and interviews with many of the personnel now active in a fairly widespread selection of existing communities, and a study of the literature in the related social sciences as have bearing on the problem.

The original basic hypotheses of the dissertation were that the categories in which satisfactory functioning to assure success are (a) operational policy, (b) economic structure, (c) personal fitness of the participants, and (d) social functioning of the total project. These were found to be fundamentally correct and inclusive. Of these, the study showed personality fitness of the members to be of greater importance, and economic structure, though very essential, to be less determinative than the other categories.

In the area of personality fitness, individual commitment to a common purpose was found to be more essential than other factors. This was seen to be affected by the nature of group motivations and purposes, and by the degree of personal maturity of the members. An element of maximum importance in assuring success was found to be the spiritual, cementing ingredient of self-giving love.

In addition to the contribution which the study can make to future success of intentional communities, significant additional findings are worthy of note. One is the Isolation of an emerging new type of intentional community within this century, as contrasted with the traditional form which has found expression during the past four or five hundred years. It reflects the basic philosophy, theology and greater worth of persons, fairly characteristic of the westward movement in the world. The contrast between this newer trend and that of the older European type of community is clearly marked as seen in the tabular listings of the community characteristics and practices.

Another important discovery is that the intentional community may be used to give purpose and direction to the development and guidance of a specific culture. This is because the small community is the seedbed for cultural pattern establishment. This latter, in turn, is closely related to the previously known, but little used fact, that small community may be a tool for the maturing process in persons, especially at the point of unconscious habit-pattern determination. The application of such understanding would fill a vital need in today's world.

291 pages. $3.64. Mic 56-928

AN EFFECTIVE MINISTRY TO COLLEGE STUDENTS: A STUDY OF THE FUNCTIONS OF THE LOCAL PASTOR IN OHIO METHODISM

(Publication No. 15,579)

Leonard Claire Warden, Ph.D.
New York University, 1955

The problem in this research is to determine the functions of the local Methodist pastor in his ministry to undergraduate students, and to evolve criteria for an effective ministry to them. The problem is divided into four parts: discovering the religious needs of undergraduates; determining the characteristic functions of Methodist pastors in college towns; ascertaining the conceptions of Methodist bishops and other church leaders concerning essential functions in ministering to undergraduates; and determining the role of the pastor in an effective ministry to undergraduates. This research moves out of a background of related studies in the general area of adolescence, seeking a definitive statement of what constitutes religious effectiveness with students, in light of which pastoral assignments to college churches may be made. Related material is abundant, but concentration here is on the pastor as an individual, using his life to influence student life through the medium of the college church.

Procedures in collecting data involved the listing of the religious needs of students from a validated bibliography, from materials secured from offices of religion at various state universities in Ohio, from Wesley Foundation units, and from the investigator's personal counseling records. Detailed functions of fifteen Methodist ministers in college towns were compiled. Seven Methodist bishops and administrative leaders contributed comprehensive statements of requisite functions for college pastors, and the same group of seven gave individual evaluations of the importance of the functions compiled for the fifteen ministers. A workshop was conducted, made up of ministers of recognized success in college pastorates, along with resource persons from Miami University, and final statements were formulated on the role of the pastor in an effective ministry to students.

Results of the research make clearly evident that effectiveness is determined by the personal way in which the individual pastor performs the basic functions of preaching, leading worship, giving pastoral care, administrating the church, interpreting religion, and participating in society as a religious person. A tangible symbol of effectiveness is the number of students the pastor influences in each area of his ministry. Some evidences of effectiveness are intangible and difficult to measure, examples being growing awareness of God and maturing philosophy of life resultant from the minister's influence. Student identification with the larger Christian fellowship beyond college years is a long term test of effectiveness. Student achievement of maturity at each stage of development, enrichment of personal life, and growing contribution to social progress and welfare, through use of religious resources, all attest effective influence by the pastor.

Certain factors such as geographical location of the church, physical facilities, and attitudes of college officials and faculty members, may be beyond the pastor's direct control. These may work for or against effectiveness.

Student religious needs are as comprehensive and varying as students are as individuals, and they cannot be condensed or summarized. The effective pastor must understand students as persons. The major functions of college pastors, just as pastors in general, relate to emphasis upon the individual. The college church requires functions identical to those in churches in other locations, but in addition requires special skills and qualities. All ministers translate religion through the medium of individual personality, and this assumes added importance in the college church. The writer appeals to bishops and others responsible for pastoral assignments to exercise utmost care in the selection of men for college churches. Apprenticeships in the ministry to students are recommended. No opportunity in the total ministry is greater or more potentially productive than the college church served by the qualified minister.

117 pages. $1.46. Mic 56-929

THE ACADEMIC ROLE OF THE COLLEGE STUDENT

(Publication No. 15,876)

Philip Winston Pendleton, Ph. D.
The Ohio State University, 1955

The two major purposes of the study were (1) to devise a method that would provide a broad and inclusive description of the academic role and allow for statistical manipulation, and (2) to provide information about the role-expectations and role-perceptions of the college student. The term academic role was used to denote the sphere of a student's activity that is primarily concerned with the course-work aspect of his college life.

The methods devised to study the academic role are as follows. In the early phase of the study, statements were collected by open-ended questioning of 386 students, 21 faculty members, and 12 parents about their definition of the academic role. These statements were used as the basis of an 86-item questionnaire administered to 404 students in courses in three different departments at The Ohio State University, to 32 faculty members teaching these courses, and to 114 parents of a sample of these students. Respondents were asked to indicate whether they agreed or disagreed with each item.

General hypotheses investigated and the findings therefrom follow.

(1) Clarity of role definition and increased agreement on the expectations of students among the members of a group will be a function of the duration and intensity of association among the various groups and individuals involved. (This was not substantiated.)

(2) There will be a moderate, positive relationship between the scholastic ability of the student and the congruence of his role-perception with the role-expectation by the instructor. (A small but significant r of .24 was obtained.) However, clarity of role-perception is hypothesized to be something other than scholastic ability as it is typically measured, and it should help to explain overachievement and underachievement. (A slightly, but not significantly, greater correlation of .34 was obtained between the accuracy of the student's role-perception and his cumulative point hour ratio. The difference between the r's of .24 and .34 is not great enough to support our hypothesis.)

(3) Sex differences will appear between the expectations by parents with sons and with daughters and between fathers and mothers, especially for such aspects of the academic role as are concerned with participation in social activities and sports and with getting a general education versus a vocationally oriented education. (Sex differences appeared in only one instance: parents and students tended to agree that college men should be getting a vocationally or professionally oriented education, whereas both parents and students were divided in their opinions concerning whether the college girl should get a general education rather than a specific one.)

(4) Finally, expectations will differ among various groups: between different departments, between different colleges, between parents and instructors, and between parents and students. (Significant differences in expectations were obtained for various groups; for example, the faculty in one department is opposed to more than one or two unauthorized absences from class, whereas the faculty in another department would permit as many as five or six.)

One conclusion to be drawn from the study is that, although differences do exist as noted in the preceding paragraph, the similarities in role-expectations and role-perceptions outweigh the differences. It is believed that greater differences might have been revealed by the use of more discriminating items (i.e., those that avoid stereotypes) and by the use of more refined scaling methods.

223 pages. $2.79. Mic 56-930

THE EFFECT OF FIELD PROCEDURES ON PUBLIC OPINION DATA

(Publication No. 15,751)

Charles Herbert Stember, Ph.D.
Columbia University, 1955

Data secured by two public opinion agencies, the American Institute of Public Opinion and the National Opinion Research Center, were compared to determine the effect of different field procedures on the results obtained in a nationwide survey on attitudes toward Communism and civil liberties. Both organizations used the same questionnaire, instructions to interviewers, and codes, and interviewed equivalent national probability samples of about 2500 adults. Each agency used its own interviewing staff trained in its own methods and processed the results with its coders and supervisors. The substantive results obtained may be found in the volume, Communism, Conformity and Civil Liberties, by Samuel A. Stouffer, who directed the study.

The present inquiry compared the results for quantitative and qualitative differences in the distribution of responses to free answer questions and some pre-coded questions.

On free answer questions, it was found that each agency secured about the same number classified as having no opinion. Responses to pre-coded questions, however, yielded significant differences in the number reported as having no opinion, presumptively reflecting the marked differences in procedure between the two agencies in traditional instructions for pre-coded questions.

Further examination of the quantity of material secured revealed that in spite of marked differences in instructions for probing and recording free answer questions, and large differences in the amount of space allowed for such answers, both agencies obtained about the same number of coded responses per respondent on the fourteen free answer questions compared. However, when on two questions a sub-sample of responses was subjected to a word count,

it was found that the agency encouraging fuller answers did in fact obtain longer replies. In order to determine whether the longer replies actually contained a correspondingly greater amount of meaningful material, new detailed codes were constructed for the two experimental questions and the material recoded and re-tabulated. In the re-tabulation it was found that the longer replies did in fact contain greater amounts of meaningful material. It was concluded that the codes originally designed for the study were better geared to the procedures of the agency obtaining the shorter replies and were not adequate for classification of the longer responses secured by the second agency.

In the analysis of the quality of material obtained it was found that the distribution of responses to free answer questions was significantly different either in total distribution or in the proportion in the major response category for eight of the thirteen free answer questions tested in the comparison. Analysis of the kinds of questions which showed significant differences, together with a summary of interviewers' expressed criticisms of the questionnaire, seemed to indicate a relationship between question reliability and situational difficulty induced by the question.

Systematic qualitative differences observed also indicated that differences in probing and recording also produced differences in response distribution. Ideological differences between the two staffs, however, had no measurable effect on results.

An examination of the responses of Northern and Southern Negro groups in the samples demonstrated that the agency which used white interviewers to interview Negro respondents obtained different distributions among the Southern Negro group from the agency which used Negro interviewers in responses to questions related to Negro-white relations. The nature of the differences suggested that Negroes spoke more freely and frankly to Negro interviewers. This was also indicated in responses to questions which dealt with controversial issues, where it was found that responses which represented an unpopular ideological position were more often given by Southern Negroes to interviewers of their own ethnic group.

157 pages. $1.96. Mic 56-931

A STUDY OF SCHOOL DESEGREGATION: SELF-PREDICTION OF BEHAVIOR AND CORRELATES OF SELF-PREDICTION

(Publication No. 15,802)

Wyman Loren Williams, Jr., Ph. D.
The University of Tennessee, 1955

Major Professor: J. M. Porter, Jr.

This study was designed to provide data that would aid in the anticipation of problems arising in the desegregation of the Oak Ridge, Tennessee, school system. Guttman scales consisting of behavioral referent items were administered to students and teachers in the system. The following attitudinal areas were explored: white students toward Negro students, white students toward Negro teachers, white students' perception of parents' attitude toward an integrated system, Negro students toward white students, Negro students toward white teachers, Negro students' perception of their parents' attitude toward an integrated system, white teachers toward Negro students, and white teachers toward Negro teachers. In general favorable attitudes, as estimated from self-prediction of behavior, toward the opposite ethnic group were found in all areas listed above.

Relationships between attitudes and various demographic variables were also investigated. Results of these analyses were in line with results of similar studies.

Preliminary validation data (overt behavior used as criterion) suggested that in this study, a fairly substantial relationship will be found between self-prediction of behavior and actual overt behavior.

106 pages. $1.33. Mic 56-932

SOCIOLOGY

SOCIOLOGY, GENERAL

DEMOGRAPHIC AND ECOLOGICAL CORRELATES OF THE CHANGING STRUCTURE OF AMERICAN CITIES

(Publication No. 15,702)

Heinz John Graalfs, Ph. D.
University of Washington, 1955

Human ecologists look upon the city as a "natural" social laboratory, since here can be found the most complete expression of the variegated aspects of human behavior. Furthermore, problem oriented sociologists, in particular, have devoted themselves to the study of such problems as crime, personal disorganization, vice, race relations, etc., almost entirely within the urban setting.

This study is concerned with some of the changes in the social structure of the city between 1940 and 1950. A number of census variables were chosen for analysis for fifteen different cities. A measure of change was computed for each of the variables and these changes were then correlated with each other in order to assess more adequately the interrelationships between the changes in these characteristics of the city. By selecting a number of cities and intercorrelating identical variables, for all of these cities, it is possible to determine whether or not the relationships between the changes in these variables are sufficiently similar or general so that the findings in one city can be taken as a generalized phenomenon of all cities.

Census tracts comprised the unit of analysis for each city. In order to guarantee strict comparability of areas between 1940 and 1950 only those tracts having identical boundaries for the two periods were used. While this

procedure eliminated some tracts from the study, the areas selected made possible meaningful comparisons of changes during the ten-year period since any changes, either in the aggregate or for each tract, are actual differences experienced by the area, because boundary changes, annexations, etc., cannot influence the comparability of the data.

Once all of the measures of change were computed by census tracts for each city, they were punched on I.B.M. cards and intercorrelation matrices for each of the cities were prepared and analyzed with the aid of a 604 Electronic Calculating Punch.

The resulting analysis showed that while some of the changes were fairly consistent from one city to another, geographical location and variations in population composition played a vital role in the growth of cities. The rising birth rate and the increase in longevity has resulted in a sharp increase in the dependent population with the result that a smaller proportion of gainfully employed workers will eventually be supporting this dependent population. Changes in the age and sex composition of the population were found to be significant factors in explaining changes in a number of other variables.

While infrequently used, correlations based on measure of change reveal relationships which cannot be determined by studies whose reference is but a single point in time.

180 pages. $2.25. Mic 56-933

A STUDY OF COHORT MIGRATION IN THE UNITED STATES: 1870 TO 1950

(Publication No. 15,724)

Marie Brase Hotz, Ph.D.
Washington University, 1955

Chairman: David B. Carpenter

This thesis is a study of migration of cohorts of the native white population in the United States between 1870 and 1950. It was undertaken for the purposes of testing the usefulness of the cohort method of measuring migration, and of investigating several hypotheses about the nature of migration in the United States.

The cohort method of measuring migration is one which infers net migration amounts from the age distributions of the states at successive census dates. Using the distributions by age and sex for each state given by all censuses from 1870 to 1950, percentages were figured in this way: the native white population in each state aged 0-4 in a given year is divided by the native white population of the United States aged 0-4 in the same year. Then the native white population of each state ages 10-14 ten years later is divided by the United States population ages 10-14 in that year. This procedure is followed for the groups ages 20-24, 30-34, and so on to the oldest age reported for the cohort by the census of 1950. Migration into a state may be inferred from these percentages when a state has a larger percentage of the cohort recorded as residents in one year than were recorded there a decade earlier.

This method of measuring migration was evaluated by correlating the percentage gains or losses in migration for each state given by this method with actual figures for migration reported by the 1940 census. The r's for the two measures were .97 for the group aged 20-24 in 1940, .92 for ages 30-34, .91 for 55-64 and .84 for the group over 65. It was concluded that the cohort method provides an adequate measure for migration.

This measure was applied to the cohorts of white persons born in the United States between the years 1856-60, 1866-70, 1896-1900, and 1916-1920. The following hypotheses were investigated:

(1) The present distribution of the aged population in the United States differs from the distribution of the younger population. This hypothesis was accepted as valid. The regions where more older persons live are the northeast and north central states, except for the Dakotas and Michigan. States in the south, except for Florida, and the mountain region, except for Colorado, are the areas where the younger portions of the population predominate.

(2) Younger persons in the nation's population migrate more than the older members of the population. This hypothesis was validated. Migration of persons under 30 is considerably larger than for persons over 59. The age group migrating most is that aged 20-24 to 30-34; the least, ages 50-54 to 60-64. After ages 30-34, population groups move less and the differences between their migrations are quite small.

(3) The number of migrations undertaken by a given cohort are in part dependent upon the time at which they were born. The more recently born are the more likely to migrate. This hypothesis was not validated. There was some indication that the more recently born cohorts were less likely to migrate.

(4) Age alone cannot account for migration currents in the United States. This hypothesis was accepted. Factors of time of migration and sex were found to influence amounts of migration.

127 pages. $1.59. Mic 56-934

SOCIAL ADJUSTMENT PRECEDING, ACCOMPANYING, AND FOLLOWING THE ONSET OF ALCOHOLISM

(Publication No. 15,706)

Joan Katherine Jackson, Ph.D.
University of Washington, 1955

This thesis explores the relationship between social adjustment and alcoholism. The social adjustments preceding, accompanying and following the development of alcoholic drinking patterns in fifty-six male, hospitalized alcoholics are described.

Social adjustments were examined during the periods of childhood, school years, adolescence and adulthood. The evaluation of social adjustment was based on extensive life histories, which had been recorded verbatim. The culturally-expected social adjustment of males was defined for each stage of life, after a review of the pertinent literature. Each patient was given a score for each life-period, and for five-year intervals throughout adulthood. This score represented the extent to which he deviated from cultural expectations during that period of life.

Six stages of drinking were delineated: non-drinking, very moderate drinking, moderate drinking, heavy drinking, early symptoms of alcoholism, and fully developed alcoholism. The stages were defined on the basis of Jellinek's

work on the drinking histories of alcoholics, and on Maxwell's study of drinking behavior in the State of Washington. The criteria for the stages were independent of social adjustment. The time at which the patient entered each phase of drinking was determined from the responses to the Jellinek Drinking History.

The findings on social adjustment suggest that alcoholics are drawn from the socially isolated. Throughout life most of the patients had problems in peer group relationships, in relationships with women, in institutional participation and in gaining emotional emancipation from parents.

They were raised in childhood homes characterized by inconsistent treatment by parents, by lack of adequate adult males with whom to identify and by parental interference with efforts to achieve maturity. The childhood homes presented an average of nine barriers to an effective socialization experience.

During the school years, the most prevalent problems were in peer group relationships. Whether or not problems were experienced in adjustment to school seemed to be related more to the socio-economic status and attitudes towards education of parents, than to be characteristic of pre-alcoholics.

Later in life the major problems were in relationships with women, in marriage and outside of marriage, in breaking emotional ties with parents, and in institutional and friendship relationships. As a group, their social adjustments tended to rest on a very narrow base of interpersonal relationships. When this narrow base of relationships was disturbed, social adjustment deteriorated, regardless of the stage of drinking at that point. Up until alcoholism, changes in social adjustment and changes in the stage of drinking did not appear to be related. After alcoholism, there was an over-all decline in social adjustment.

When the lifetime adjustment patterns of individuals were examined, there appeared to be three major patterns and one minor pattern. The major patterns were: an inadequate adjustment throughout adulthood; a prolonged period of adequate adjustment, followed by an abrupt deterioration of adjustment; and a wavering adjustment pattern, showing vascillations between adequate and inadequate adjustment throughout adulthood. The minor pattern was a gradual deterioration of adjustment.

Two major patterns of developing alcoholism were found, and one minor pattern. The sudden onset of alcoholism, after a long period of stabilized drinking, tended to be associated with the abrupt deterioration of life adjustment; a gradual onset of drinking tended to be associated with a gradual deterioration of life adjustment; and inadequate adjustment throughout adulthood tended to be almost equally divided between abrupt onsets and gradual onsets. The minor wavering pattern of developing alcoholism, that is, of movements backward and forward along the continuum of drinking, tended to be associated with a vascillating adjustment pattern. It was suggested that under a different scoring system for adjustment, the always inadequate adjustment patterns would have been divided between the gradual deterioration and abrupt deterioration patterns and the association of adjustment patterns with patterns of developing alcoholism would have been more clear-cut. Life crises appeared to be related both to changes in adjustment and to changes in drinking, until after the onset of alcoholism.

Further research is needed to determine whether the problems in social adjustment, and the lifetime social adjustment patterns found in this study, are characteristic of alcoholics, or of all individuals who have problems in making and maintaining adequate adult social adjustments.

360 pages. $4.50. Mic 56-935

THE MECHANICS AND EFFECTS OF DIRECT AND SOCIALLY MEDIATED CHANNELS OF CONTACT IN MESSAGE DIFFUSION

(Publication No. 15,709)

Otto Nyholm Larsen, Ph.D.
University of Washington, 1955

The present thesis developed out of a large-scale research program called "Project Revere" conducted in the Washington Public Opinion Laboratory during 1951-54 under a contract with the United States Air Force.

The research here reported centers on the analysis of the processes of disseminating information and achieving communication. An attempt is made to determine to what extent the effectiveness of the mass communicative act depends on the degree to which a medium is linked to interpersonal networks and on the characteristics of those networks.

The empirical content of this thesis is based on three separate studies from three different research settings of Project Revere.

The first study involves an air-dropped leaflet operation whose target was the population of eight small towns. The data were collected in the form of face-to-face interviews with 1,593 respondents selected by random sampling procedures. The main inquiry is directed toward understanding of the relative role of the direct and socially mediated channels of contact in establishing communication between the originating source of the message and the ultimate receivers of the information. Communicative effectiveness is measured in terms of the number of message knowers, the accuracy of message recall, and the degree of communicative compliance claimed by the respondents. The relationship of these criteria of effectiveness to such variables as stimulus intensity and the age, sex, family size and social distance characteristics of the population is reported. In addition, the validity and reliability of responses to the interviews has also been determined. In general, the findings show that the originating source of the message was quite dependent upon social diffusion or the development of secondary transmission roles for the effective spread of information. However, different segments of the population were variously involved in the transmitting and receiving roles, depending on whether the particular form of social interaction was purely oral in character or also involved the passing on of the printed message.

The second study of this thesis reports impressions from a stress situation where a disaster in the form of a forest fire threatened a small community. The nature, development, function, and control of rumors, a particular class of oral communication, is discussed. The general emphasis of the analysis is on recognizing the situational context as an important variable in communication's research, and on suggesting certain research techniques for the future study of communication processes in disasters.

The third study of this thesis relates the flow of information to the changing structure of group relations in two test communities consisting of 42 and 60 boys in a summer camp. This research is directed toward evaluating the relationship between interpersonal communication and variables designating the social status and social mobility of persons in transmitting and receiving roles. The data were collected in the form of self-administered sociometric schedules and face-to-face interviews with the two test groups.

The findings of the two parts of this third study were not entirely consistent. Nevertheless, together these findings suggest the importance of sociometric connections as a critical class of constraints or influences on the diffusion of information. The findings further emphasize the utility of viewing the structure of a group in terms of multiple status hierarchies which may well be changing at different rates with contrasting implications for a given individual who may at one time have many statuses while fulfilling one communication's role (transmitter or receiver) in an information network. The findings also suggest that newly formed groups, different in original composition, confronted with a similar task environment, tend in the course of time to develop relatively similar patterns of interaction and relatively stable social systems.

358 pages. $4.48. Mic 56-936

AN EXPERIMENTAL STUDY OF THE RELATIONSHIP BETWEEN THE STRUCTURE AND THE FUNCTIONING OF PROBLEM SOLVING GROUPS

(Publication No. 15,710)

Herman John Loether, Ph.D.
University of Washington, 1955

This study revolved around the general question of the relationship between the intellectual product of the group and the intellecutal products of the individual members of the group. The particular intellectual task under investigation was the solution of a number of riddles in rhyme.

The major dependent variable of the study was the margin of the difference between the productivity of the group and the productivity of the individual members of the group. The major independent variables were group size and situation — cooperative or competitive.

Of central concern was the question of whether the two independent variables increased or decreased the magnitude of the dependent variable — the margin of difference between the group and individual products.

A factorial design was used to investigate the relationship between the major independent and dependent variables. Group size, situation, and the order of presentation of two different parts of the riddle work sheet (each of which contained ten riddles) were varied simultaneously. Group size was varied four ways: size one, size two, size four, and size six. Situation was varied two ways: cooperative and competitive. Order of presentation of the two parts of the riddle work sheet was varied in order to take into account differences in difficulty between the two parts.

The subjects used for the experiment were 104 volunteers from lower division sociology classes at the University of Washington during the Spring Quarter of 1955.

The experimental design was executed twice using fifty-two subjects for each execution. First, fifty-two subjects worked as individuals on ten riddles for twenty minutes. Then the subjects were randomly assigned to the various experimental conditions and allowed to work for twenty minutes more on ten more riddles. Four of the subjects worked as individuals during the second twenty minute session, while the other forty-eight worked as members of groups of various sizes in either cooperative or competitive situations. Those subjects who worked on part A of the riddle work sheet during the first twenty minute session worked on part B during the second session and vice versa.

Three indices of the margins of difference between group products and the products of the individual members of groups were used. Margin of Difference (M_a) compared the group product with the mean individual product of the group members. Margin of Difference (M_d) compared the group product with the number of different riddles solved by the individual members of the group. Margin of Difference (M_h) compared the group product with the product of the most productive individual group member. Analysis of Variance and t tests were used in the statistical evaluation of the data.

Analysis of the data revealed that the products of the groups were significantly greater than (1) the mean product of the individual members of the groups, (2) the sum of different riddles solved by the individual members of the groups, and (3) the products of the most productive individual members of the groups.

In general, the margins of difference for groups of sizes four and six were greater than those for groups of size two or for individuals. No significant differences were found between the margins for individuals and those for groups of size two. The margins for groups in the cooperative situation did not differ significantly from those for groups in the competitive situation.

The congruence between an individual's rating of his productivity and his fellow group members' ratings of his productivity did not differ significantly from the cooperative to the competitive situation.

177 pages. $2.21. Mic 56-937

SOCIOLOGY, PUBLIC WELFARE

A STUDY OF THE PROCESS OF AFFILIATION WITH ALCOHOLICS ANONYMOUS

(Publication No. 14,782)

Harrison Miller Trice, Ph.D.
The University of Wisconsin, 1955

Supervisor: Professor Michael Hakeem

Although Alcoholics Anonymous has been generally regarded as an effective form of group therapy for persons with a drinking problem, the process whereby one alcoholic comes to affiliate with it, while another does not, has never been investigated systematically. The guiding question of this research has been: what explains the fact that among

all the persons characterized by a compulsion to drink, with many common experiences and emotional feelings among them, some are able to affiliate with an A.A. group, while others are not?

After extensive field work with both active A.A. members and hospitalized non-affiliates, hypotheses were formed to explain affiliation and non-affiliation with Alcoholics Anonymous. These were as follows: First, alcoholics who affiliate with A.A. will be different from those who do not affiliate with A.A. in their self-conceptions and associational experiences prior to attending any meetings. Second, affiliates will differ significantly from those who did not affiliate with respect to initial contact experiences with the group. Third, affiliates will differ significantly from those alcoholics who did not affiliate relative to group experiences and attitudes after attending meetings for a few weeks.

Data to test these hypotheses were collected from 252 persons with severe drinking problems. Of these, 119 were affiliates with A.A., i.e., had attended meetings at least twice a month during the past year, while 133 were non-affiliates. These persons responded, either true or false, to a list of statements concerning their experiences with A.A. These responses were then manipulated statistically to determine if there was any relationship between them and affiliation as contrasted to non-affiliation.

From this comparison there is revealed a process of affiliation with A.A. in three stages, namely, experiences before going to any meetings, those at the time of first going, and those immediately after going. If an alcoholic conceives of himself as a defeated alcoholic who can share his personal problems with others, if he had, before going to any meetings, lost his drinking friends, if he did not have a model of "will power" provided by a respected friend or relative who had quit drinking "by their own will power," and if he had been exposed to the favorable communication that A.A. members were sincere, he was in a favorable position to affiliate with A.A.

If these preparatory features are present, the process of affiliation is unfolded further by certain experiences at the time of first contact. If an alcoholic has, at this time, an accurate expectation of what A.A. meetings are like, if he does not have a sensitivity to social class symbols, if he is characterized by a readiness to join that is composed of values that take precedence over the "pleasures" of drinking, if he experienced a closeness of contact with members upon first attending, the affiliative process is well underway.

The process reaches culmination in experiences that take place after attending meetings for a few weeks. If, at this time, the alcoholic has come to be a part of informal activities, if he experiences no problem in abandoning his drinking associates, if he discovers there are other associates to replace his drinking associates, and if the support and participation of the wife (or girl friend) is present, the process of affiliation comes to be "locked-in." If other relatives do not provide emotional and financial support to the alcoholic who is trying to affiliate, a strong influence is added to the process.

From this process the barriers to affiliation were deduced. If a conception of self that is uncertain about defeat, about emotion-sharing and about being an alcoholic combines with an excess of contacts with an esteemed relative or friend who "quit by their own will power," a barrier to affiliation of the most intense kind is present. Other obstacles operate, in conjunction with these, to prevent affiliation.

From these considerations a form of pre-A.A. group therapy for clinics and hospitals is suggested. This would aim at reducing the barriers to affiliation. Also present in the data are conclusions regarding attraction to groups in general, and concerning the theory of differential association in particular. 252 pages. $3.15. Mic 56-938

SOCIOLOGY, RACE QUESTION

SCHOOL DESIGNED PROGRAMS AND PROJECTS ON SELECTED SOCIO-ECONOMIC PROBLEMS OF NEGROES IN MARYLAND

(Publication No. 15,555)

Percy V. Williams, Ed.D.
New York University, 1955

Chairman: Professor Robert K. Speer

Purpose

The purpose of this study was to find out the extent to which the schools for Negroes designed programs and projects on selected socio-economic problems of the Negro community.

Procedure

The major problem was broken down into four sub-problems. Data were gathered on ten selected areas of socio-economic problems of Negroes and the school facilities and opportunities from such primary sources as the United States Census, Reports from the State Department of Health and State Board of Education, and such secondary sources as research documents from the University of Maryland. Data were also secured by interviews from responsible school leaders from each of the schools in the study to determine the extent to which the schools were aware of and sensitive to the socio-economic problems of the Negroes and the extent to which they had set out to design programs in order to alleviate some of the conditions.

Treatment of Data

The socio-economic data were analyzed to find the acute problems facing Negroes. Data on school facilities were analyzed to gain insight into the extent to which:

1. There were available school facilities for Negroes
2. The Negroes take advantage of the educational facilities
3. The qualities of service are determined by participation or use of facilities.

There were only fourteen school-designed programs or projects which were discovered during the interviews in the forty-one schools, in such quantity and quality to meet the criteria which were set up. Each of these programs or projects were summarized for the study.

Findings and Recommendations

The socio-economic conditions of Negroes in Maryland are sufficiently acute to warrant the attention and attack by several agencies. The school has a residual function, and can rightfully be expected to assist with the solution to

many of these problems. This is especially true since the school facilities are reasonably adequate when compared with facilities provided for white youth in the state. All of the forty-one schools included in this study were aware of the socio-economic conditions of Negroes in the community because each school had conducted one or more surveys on some socio-economic problems. There was variation in the extent of awareness because some schools had more detailed studies and some schools had set up programs to work on the problems. There were certain socio-economic problems that were acute, but little seems to have been done about the problems by any agency. A large number of surveys and certain very acute problems were found, but the small number of projects designed to alleviate the conditions indicated that school leaders may not have sufficient skill or know-how to attack those problems through the school. This suggests that teacher training institutions need to be alerted for the possibilities inherent in teacher training for giving prospective teachers some skill in this area. Since Negroes have made least progress in participation in community life, and since the opportunity is now available for Negro teachers to learn about Maryland public affairs through the Institute on Maryland Public Affairs, it is recommended that Negro teachers sieze the opportunity and utilize it to educate others in correct participation in community activities.

Implications

Leadership on the part of school personnel seems to be a basic requirement and the catalytic agent for increasing the number of programs and projects to improve socio-economic conditions. For it is leadership through conferences and other organizational and administrative techniques which help given teachers or a whole system to recognize and distinguish between the symptoms and the causes of low scholastic achievement. Likewise, it is leadership on the part of responsible school officials which gets school personnel to chart the course and direct its activities toward reorganizing a curriculum to alleviate the conditions.

233 pages. $2.91. Mic 56-939

SPEECH - THEATER

A STUDY OF THE RELATIVE EFFECTIVENESS OF THE USE OF PRAISE AND REPROOF IN INFORMATIVE SPEAKING UPON AUDIENCE COMPREHENSION AND RETENTION

(Publication No. 15,822)

Jack Buehl Cullen, Ph.D.
The Ohio State University, 1955

The study was planned to determine the relative effect of praise and reproof in securing audience comprehension and retention when presented in an informative speech.

That informative speaking is one of the most frequently used types of speech is well recognized. Certainly in the field of education, imparting information orally is of great importance. However, a survey of the literature in the field of speech did not reveal this importance; instead, a noticeable scarcity of articles and reports of research on this type of speech was evident. The analysis of literature in speech, education, and psychology also revealed a paucity of information concerning the effects of praise and reproof when used in the informative speech. The apparent need for such information brought about a desire to secure data which could shed some light on this problem. These data were gathered through the following research procedure.

First, two lectures on "developing confidence" were composed, differing only in their use of praise and reproof as an element of style. Two speech instructors were chosen to deliver these two lectures. Each instructor delivered the two speeches (praise and reproof), one to each of his two beginning speech classes, during the third week of the course. Immediately following these lectures a thirty-four item, multiple-choice test covering the information contained in the lectures was given to the experimental groups, a control group, and another group of college students who did not hear either lecture but read the material contained.

Three weeks later the same information test was repeated with the experimental and control groups. Two distinct class atmospheres were established in order to create the proper setting for the two lectures. The classes hearing the praise lecture were to be handled permissively while the classes subjected to the reproof lecture were to be taught in a restrictive manner. A rating scale was constructed and administered to the experimental groups in order to validate the class atmospheres established and teaching procedures used.

A set of informative speeches of the experimental subjects were recorded and judged in order to determine whether these two methods of teaching produced any difference in student speaking achievement. A small sample of the subjects were interviewed in order to obtain a cross section of student reactions to the two different teaching procedures.

The results of this research methodology were:

1. There was no statistically significant difference in the amount of audience comprehension or retention of information as the result of using praise or reproof in the lectures.
2. Both the praise and the reproof style of lecture produced a significant amount of audience comprehension and retention.
3. There was a significant amount of forgetting of the oral information contained in the lectures during a three-week period.
4. There was no difference in the amount of speaking skill exhibited by these classes taught in the two different atmospheres of praise and reproof.
5. There was no difference in the amount of comprehension between the groups listening to the lectures and the groups reading the same material.

6. The subjects responded differently to the scale evaluation of the instructors when confronted with the two teaching procedures of permissiveness and restrictiveness. 180 pages. $2.25. Mic 56-940

A STUDY OF THE GROUP THEATRE AND ITS CONTRIBUTIONS TO THEATRICAL PRODUCTION IN AMERICA

(Publication No. 15,834)

Raymond Dominic Gasper, Ph.D.
The Ohio State University, 1955

The purpose of the study is to examine specifically the contributions of the Group Theatre to American theatrical production, not only in terms of its own work or the theatre of its own day, but also in terms of its influence on the present-day theatre.

The procedure followed has been to examine, first of all, what the Group stood for as a theatre, and second, the relationship of the producing artists to the organization. The discussion takes up questions dealing with its objectives, policies, and methods, and treats the development of the theatre artists.

The discussion is divided into three major parts. The first deals with the history of the Group Theatre from its inception to its close: the reasons for its establishment; the procedures involved; the people connected with the theatre; the productions; the problems, financial, emotional, and artistic; the summer sessions; the training classes; the selection of plays; and the causes of its dissolution.

The second part takes up the question of the Group's "idea of theatre": the concept of theatre as a social institution; the concept of theatre as an art form; the practical requirements for the operation of a theatre; the purposes of a theatre, the needs of a theatre; the integration of artists in a theatre; the need for experimentation; what constitutes a theatrical production; what a well-rounded theatre program should include; and what a theatre should offer its artists and its audience.

The third part deals with the production artists: the director as the master artist and teacher; a definition of the art of directing; a directing method; an integrated permanent company of actors; ensemble acting; an acting method; a designer's working relationship with a theatre and a production; the requirements of a stage setting; the question of style in production; the relationship of a playwright to a permanent theatre, social drama and new types of plays; the training and development of new producers, directors, actors, playwrights, designers, and other theatre workers.

Considerable space is given to the activities of former Group people in the present-day theatre: organization of other theatrical enterprises; teaching the Group methods; and producing, directing, acting, designing, and writing for the contemporary stage and motion pictures.

Out of the life of the Group, its works, its aims, its ideals, and its artists, have emerged an "idea of theatre" and the practical means for putting it into operation. Its contributions include not only the concrete achievements of its history — productions, plays, projects, and training of artists — but also certain ideals and theories which are adhered to still, not only by its own members, but by a large portion of the theatre world. The Group was responsible for the development of a number of creative theatre artists who are maintaining the Group's way of theatre and are training others in its precepts.

With the Group came a "new theatre" to America, a new movement which has gained momentum through the years until today it is recognized as the dominant school.

404 pages. $5.05. Mic 56-941

A STUDY OF THE EFFECT OF VOLUNTARY NON-FLUENCY UPON FREQUENCY AND RATED SEVERITY OF AUDIBLE CHARACTERISTICS OF STUTTERING

(Publication No. 15,869)

Rex Vaughn Naylor, Ph.D.
The Ohio State University, 1955

The purpose of the study was to evaluate the effect of a brief use of voluntary non-fluency upon frequency of stuttering and severity of audible characteristics of stuttering. Each of 15 adult male stutterers made tape-recordings of three successive readings of a 500-word passage under each of the following conditions:

Condition I, reading without voluntary non-fluency; Condition II, reading with voluntary non-fluency all words on which stuttering was anticipated or on which stuttering occurred; Condition III, reading with voluntary non-fluency a designated 10 per cent of the first 300 words, and without voluntary non-fluency the final 200 words; Condition IV, reading with voluntary non-fluency a designated 30 per cent of the first 300 words, and without voluntary non-fluency the final 200 words.

Four experimental passages were equated with respect to (1) length, (2) content, (3) readability, and (4) likelihood of stuttering, in a manner that allowed comparisons among passages and between the first 300 and the last 200 words. Assignment of passages to conditions and order of conditions were each randomized independently for each subject. An interval of at least two days separated successive conditions for each subject.

Listening to the recorded passages in random order, the experimenter marked on copies of the passages words he believed to be stuttered in Conditions I, III, and IV. He rated each stuttered word on a nine-point equal-appearing-intervals scale, with one representing least severe, and nine most severe, stuttering. Mean severity of stuttering on individual words was computed for each reading for each subject in Conditions I, III, and IV. Comparisons between the first 300 and the last 200 words required adjustment of these basic measures.

A group of 14 undergraduates untrained in speech pathology rated the severity of the second minute of each reading in Conditions I and II. They used a nine-point scale of severity but made ratings at consecutive 10-second intervals. Mean severity for each reading for each subject was computed from obtained median scale values of severity of the 10-second segments.

From analysis of the data, the following statements may be made:

1. Voluntary non-fluency, as used, probably has no

important effect upon frequency of stuttering or upon the mean severity of audible characteristics of individual stuttered words during oral reading.

2. The adaptation expected with repeated readings of a passage occurs when voluntary non-fluency is employed on all feared or stuttered words, and adaptation is measured in terms of over-all mean severity measures obtained from the responses of a group of observers untrained in speech therapy. When voluntary non-fluency is used on designated words within a portion of each reading, adaptation in frequency of stuttering also occurs; however, when adaptation is measured in terms of mean severity of individual stuttered words, there is no evidence of the expected trend.

3. There is no evidence that adaptation trends, measured either in terms of frequency or of mean rated severity of individual stuttered words, vary with different amounts of voluntary non-fluency. Similarly, there is no evidence that the adaptation trend of over-all severity means obtained from responses of observers untrained in speech therapy is affected by the use of voluntary non-fluency.

4. When the stutterer chooses his own pattern of voluntary non-fluency during oral reading, the speech sounds more severely stuttered to the listener untrained in speech pathology than when the stutterer employs his usual manner of stuttering.

5. Individual stutterers apparently respond differently to the use of voluntary non-fluency with respect to its effect on the frequency and the severity of audible characteristics of their stuttering. 159 pages. $1.99. Mic 56-942

NORMAN THOMAS: A STUDY OF HIS SPEAKING CAREER AND HIS TECHNIQUES AS A SPEAKER

(Publication No. 15,896)

Eugene Vasilew, Ph.D.
The Ohio State University, 1955

It has been often said that Norman Thomas is one of the three or four top-ranking public speakers in America. He has also been widely acclaimed for the beneficial influence of his speaking on American politics despite the fact that he has never been elected to office.

The study set out to achieve three aims: (1) to present a full-length portrait of Norman Thomas; (2) to provide basic information about his speech training and his speaking career; and (3) to make a rhetorical analysis and evaluation of his techniques as a public speaker.

The work is divided into two parts. Part I, consisting of ten chapters, is mainly biographical. It traces Thomas' life from his birth in Marion, Ohio, through his education in grammar and high school, Princeton, and Union Theological Seminary, and deals with his experience in religious-social work, his conversion to socialism, and his long career as a Socialist. The major emphasis is on his speech training and his speaking career.

The important information in this part of the study may be summed up as follows:

1. Thomas' background was in every way conservative: he came from a Midwestern middle-class home, his religious training was Calvinist, and his political environment was Republican.

2. His boyhood pursuits were almost wholly intellectual. He was a brilliant student in both grammar and high school, and he showed, even then, a superior speaking ability.

3. He acquired significant speaking experience at Princeton. He was a member of Whig Hall and the varsity debate team, and he made an unusually distinguished record as a speaker and debater. He learned much of political theory under Woodrow Wilson, and he left Princeton with a strong interest in politics and law.

4. The impetus of his early home life, however, led him to become a minister. At Union Theological Seminary he received extensive training in homiletics. He turned from religious-social work to socialism under the influence of World War I and his experience in slum districts in New York.

5. Thomas' speaking career began during World War I, developed more fully when he became a Socialist, and reached its peak in the years 1932-34. Though he was heard frequently as a Socialist candidate, he was nearly always popular as a lecturer and achieved renown as a debater.

Part II of this study consists of four chapters. One deals with Thomas' ideas, two concern his speaking techniques, and the final chapter assesses him as a politician, party leader, and speaker. It is quite clear that Thomas' socialism is essentially founded on Christian ethics although he long ago severed all connections with the church and even rejected the Christian concept of God. As both politician and party leader he had overwhelming weaknesses.

Thomas is deeply devoted to public address as a democratic political tool. He knows rhetorical theory only sketchily, but he accumulated a wealth of experience and profited from what it taught him. It is possible to say about his speaking techniques that they are fundamentally Aristotelian, and that by standards of the art of rhetoric Thomas is an excellent speaker. His strengths as a speaker lie in a combination of erudition and preparation which makes him master of his content, in his constant and careful attention to audience adaptation, in his enormous personal appeal, and in his superior delivery. The study also draws the conclusion that Thomas, in addition to his excellence as a speaker, is effective and influential not as a politician in the usual sense, but as an educator, agitator, and propagandist. 343 pages. $4.29. Mic 56-943

THE LIFE HISTORY OF THE GIZZARD SHAD, DOROSOMA CEPEDIANUM (LESUEUR), IN WESTERN LAKE ERIE

(Publication No. 15,815)

Anthony Bodola, Ph.D.
The Ohio State University, 1955

Lake Erie is the heaviest producer of commercial fishes, on a unit area basis, of all the Great Lakes. Recently the possibility has been recognized that much of this lake's productive potential is being passed through fish species not desirable in our commercial markets. One of these species is the gizzard shad. Large numbers of shad are increasingly evident in Western Lake Erie. It seems timely to learn the ecology of this species here so that future management may be possible.

During the years 1952 to 1955, some 30,000 gizzard shad have been collected and studied. The fish were aged, sexed, weighed, and measured. Scale measurements were taken, ovaries were weighed, and "stomach" contents were analyzed. Histological sections were prepared, showing maturation of shad eggs and the seasonal appearance of ovaries. Gut development is shown by camera lucida drawings. A simplified nomographic method of back-calculating fish length from scales is included.

The gizzard shad in Western Lake Erie spawns from May to July, inclusive. Its peak spawning in 1954 occurred during the first week of June. The II-yr. shad have a longer spawning period than have the I-yr. shad or the III-yr. or older. Males and females spawn for the first time in their third year of life (90 per cent). A few spawn earlier, a few begin later. Shad older than III-yr. often show degenerated ovaries. Eggs which are not spawned are absorbed. Spawning occurs mostly in shoal water. The young, which hatch in from 36 hours to four or five days, were first collected during the latter part of June. The orderly sequence of foods consumed according to age is as follows: protozoans, then zooplankters, and finally an indiscriminate filtering of the water of zooplankters and phytoplankters and various kinds of debris and mud. Sand is also ingested, undoubtedly from the lake bottom. Most rapid growth in length occurs during their first year of life, while that in weight occurs during their second year. Compensatory growth is clearly evident — the younger of the I-yr. group overtaking the larger members of that group by the fourth year of life. The shad form their first annulus during the last week of May. Most of them form their second or later annulus during the last week of June and the first week of July. Fish lengths calculated from scales agree well with the lengths of captured fish at similar ages. The shad at Western Lake Erie were found to grow faster and to a greater length and weight than they do elsewhere, as noted in the literature — though perhaps they die earlier. The oldest shad collected were VI-yr. ones (only 3). Egg counts indicate that the individual shad spawns from about 200,000 to 500,000 eggs per season. The ovary attains a peak weight for 500-600 gram fish, with lighter and heavier fish giving lower ovary/body weight ratios. The precocious I-yr. female shad produces about 20,000 to 100,000 eggs. She spawns in late July. 141 pages. $1.76. Mic 56-944

THE EMBRYOLOGY OF THE PUPAL PARASITE PIMPLA TURIONELLAE (L.) WITH SPECIAL REFERENCE TO THE MIGRATION OF THE GERM CELLS (HYMENOPTERA: ICHNEUMONIDAE)

(Publication No. 15,582)

Joan Frances Bronskill, Ph.D.
Cornell University, 1955

Superficial cleavage in the egg of the ichneumonid parasite Pimpla turionellae results in the formation of a blastula consisting of columnar blastodermal cells and a central yolk mass (deutoplasm) in which are dispersed the primary yolk cells. At this stage, some of the cleavage cells become associated with the germinal cytoplasm (oösome) at the caudal pole and project from the posterior end of the embryo. These are the germ or pole cells.

Ventrally and laterally the blastoderm differentiates into the germ band, and dorsally into the dorsal strip and serosal caps. These latter become the serosal membrane which envelopes the entire embryo and persist until hatching, while the former differentiates into a middle and two lateral plates. As the middle plate sinks beneath the lateral plates (ectoderm) to form the inner layer (mesoderm) segmentation of the three plates occurs, with grooves demarcating the maxillary segment being the first to appear. At this time the primary entoderm forms from the primary yolk cells. It is digested with the remaining yolk cells at the time of hatching. The anterior and posterior mesenteron rudiments extend as single ribbons over the dorsal surface of the deutoplasm and engulf the remaining yolk to form the wall of the mid-gut. The anterior mesenteron rudiment forms the floor of the stomodaeal invagination. The proctodaeum develops as a result of the dorsal movement of the caudo-ventral blastodermal thickening and the ventro-mesial union of the lateral plates.

The germ cells, which enter the embryo through the proctodaeal invagination at the time of its formation, become associated with the posterior mesenteron rudiment and appear to be carried into the body cavity with the mesenteron ribbon as it proliferates cephalad. At the posterior end of the deutoplasm the germ cells divide into two masses. Each mass continues cephalad to its definitive position in the seventh abdominal segment. Prior to the general inclusion of the germ cells within the proctodaeum there is some indication of an interblastodermal passage of a few free germ cells through the posterior blastodermal thickening.

An acron and four head segments differentiate from the

anterior third of the germ band demarcated as presumptive head tissue. Two general movements are involved in the development of the head: a mesiocaudal advancement of the dorsal ectoderm, and a mesio-cephalic migration of the three gnathal lobes on the ventral side of the embryo, resulting in the formation of a prognathic head. The labrum develops as a non-lobular ridge, and the antennae become quite degenerate in the mature embryo. The intercalary segment, consisting mainly of neurogenic tissue, is non-appendicular. Rudimentary and transitory thoracic and abdominal appendages develop. The provisional dorsal closure, which develops from the dorso-lateral extremities of the embryonic ectoderm, covers the dorsal surface of the deutoplasm following the severance of the serosa from its dorsal attachment to the embryo. No antennal coelomic sacs were observed, however, continuous rudimentary coelomic tubes are present in the lateral mesoderm. The Malpighian tubules develop from the anterior end of the proctodaeum. During development the embryo retains the original cephalo-caudal axis of the egg with little blastokinesis occurring.

The embryogenesis of Pimpla turionellae is more similar to that of the aculeate Apis mellifera than to that of the sawfly Pterionedea ribesii or of the few other ichneumonids that have been studied embryonically.

95 pages. $1.19. Mic 56-945

THE BIOLOGY AND CONTROL OF THE SALT-MARSH SAND FLY, CULICOIDES FURENS (POEY), (DIPTERA: HELEIDAE)

(Publication No. 15,838)

Robert Lee Goulding, Jr., Ph.D.
The Ohio State University, 1955

Human annoyance which is due to the biting activities of the salt-marsh sand fly, Culicoides furens (Poey), results in a decided economic loss to resorts in tropical and subtropical coastal location.

As a prelude to studies on the biology and control of this pest on the lower east coast of Florida, equipment and methods were developed for sampling populations of larvae in the marsh soil, emerging adults, flying adults, and feeding adults.

The distribution of the larvae is coincident with the distribution of mangrove forests. Larval density is related to soil-surface elevations, with as little as three inches making the difference between dense or sparse populations.

Introduction of a mosquito ditch into the larval environment resulted in high concentrations of larvae on the ditch shoulders.

Adults were found to occur at least 2.5 miles inland from the salt marsh. The adult population is diluted by about 80 per cent in the first 1/2 mile from the marsh.

Four annual broods of sand flies are thought to occur. Adults from these broods appear in March and April, June and July, August and September, and November and December. The period for development of the first brood is twelve weeks; the other three broods each take six or seven weeks.

Periods of intense flight activity are associated with low wind velocities and subdued illumination. The most intense activity occurred during periods of temperature inversion. High tides, occurring in the early morning, were found to have a modifying effect upon local temperatures and stability of the air.

DDT emulsion, applied at the rate of 0.25 lbs. per acre at nightly intervals to about 75 acres near the marsh, resulted in very satisfactory control on adults. Application of 2.5 per cent DDT in oil to 4,000 acres of salt marsh by means of an airplane failed to produce a satisfactory control.

Several chemicals were tested as soil poisons against the larval stage. DDT and toxaphene were found to be of little value. Dieldrin, aldrin, heptachlor, chlordane, and benzene hexachloride gave satisfactory controls. Dieldrin at 2 lbs. per acre gave a high level of control for 65 weeks. Insecticide-impregnated granules were superior to insecticide in oil formulations because the granules penetrated the dense mangrove foliage and reached the marsh soil habitat of the larvae. 197 pages. $2.46. Mic 56-946

THE BIOLOGY AND CONTROL OF THE CORN EARWORM (HELIOTHIS ARMIGERA, HUBNER) ON LONG ISLAND, NEW YORK

(Publication No. 15,490)

Robert George Howe, Ph.D.
Cornell University, 1955

This study was undertaken to develop a control program against the corn earworm using high clearance self propelled sprayers and dusters under Long Island conditions.

The work was conducted over a four year period from 1951 to 1955 and consisted of field experiments utilizing power equipment and hand applicators and tests conducted in the laboratory. The analysis of variance was used to test the significance of all variations in the field experiments. Results are as follows:

1) The biology of Heliothis armigera Hubner under Long Island conditions is comparable to other areas which have the same environmental and weather conditions.

2) To achieve adequate control of the insect it was necessary to vary the timing of the applications throughout the growing season by shortening the intervals between applications during periods of warm weather (above 80°F.) and lengthening the intervals during cool weather (below 75°F.).

3) There appeared to be no advantage to shortening the interval between applications to two days or in increasing the number of applications to six.

4) No significant differences resulted in increasing the gallonage from 25 to 50 gallons, or pressure from 80 p.s.i. to 120 p.s.i. Both cone and fan type nozzles gave adequate control.

5) DDT at the rate of 3 qts. of a 25% emulsifiable concentrate to the acre gave control comparable to a 5% DDT dust. During periods of low infestations concentrations of DDT as low as 1 qt. of the 25% emulsifiable concentrate to the acre gave adequate control.

6) No insecticide tested was as effective in controlling the corn earworm during the entire growing season as DDT.

7) Better control resulted when care was taken in adjusting spray booms to ensure adequate coverage of the corn silk.

8) In field experiments mineral oil, Kremol 70, added to DDT significantly increased the latter's efficiency during

cool damp weather but failed to do so during periods of warm dry weather. The control achieved by mineral oil alone decreased significantly from concentrations of 10% through to 5%. In laboratory tests where petroleum fractions were applied directly to eggs of the corn earworm, excellent control was achieved with concentrations as low as 0.5%.

The results indicate that a successful control program directed against the corn earworm using high clearance self propelled sprayers and dusters is of a complex nature. Control is dependent chiefly upon temperature which influences the proper timing of applications in relation to silking of the corn ears, the incubation period of earworm eggs, and the length of intervals between applications to ensure adequate coverage of the growing silk with an insecticide.

The general conclusions are that two schedules are needed in a seasonal control program against the corn earworm, a warm and a cool weather schedule. When the temperature is over 80° F., it is necessary to spray every three days applying the first treatment when 20% of the ears are in silk. When temperatures are below 75° F., the growing rate of the silk is less rapid and the incubation period of the earworm eggs is lengthened from 2 to 8 days; during these periods the corn should be treated every four days, the first treatment being applied when 40% of the ears are in silk. DDT at the rate of 3 qts. of a 25% emulsifiable concentrate in 25-50 gallons of water to the acre applied at 80-120 p.s.i. with four cone or fan type nozzles to the row gives adequate control as does a 5% DDT dust applied at the rate of 40-50 pounds per acre. Mineral oils exhibit ovicidal activity when applied directly to the eggs of the corn earworm; however, in field tests mineral oils are not effective at concentrations below 7.5%. Mineral oil should be added to DDT during periods of cool weather but it is not necessary during warm dry weather. Although some insecticides tested compared favourably with DDT at moderate and low infestations, they could not replace DDT in a spray program throughout the entire growing season.

116 pages. $1.45. Mic 56-947

THE BIOLOGY OF AN AQUATIC PYRALID, CATACLYSTA FULICALIS CLEM. (LEPIDOPTERA), AND ITS TACHINID PARASITOID, GINGLYMIA ACRIROSTRIS TOWNS. (DIPTERA)

(Publication No. 15,847)

Ira Edward Wight Huffman, Ph.D.
The Ohio State University, 1955

The object of the dissertation was to investigate and describe the life cycles of an aquatic moth, Cataclysta fulicalis Clem. and its parasitoid fly, Ginglymia acrirostris Towns.

Cataclysta fulicalis Clem. is common from northeastern United States to the southern Great Lakes region, with records from Oregon, Washington, Arizona, New Mexico, and Texas. Most moths in the Scioto River below Griggs Dam in Franklin County, Ohio, have three generations a year.

In the daytime the adult moths feed on nectar and copulate, facing opposite directions, usually under leaves. Oviposition usually takes place at night, and the gravid females probably dive into the rapidly flowing water. In the laboratory they have been observed swimming under water, with the aid of swimming scales on the meso and metathoracic legs, and ovipositing on rocks at the bottom of a small aquarium. A thin film of air surrounds the body, and an air bubble is present under the wings. The eggs, which are found in flat masses cemented to rocks, may be as much as three feet below the surface of the flowing water and as much as twenty feet from the nearest exposed rock.

Caterpillars hatch from the egg by tearing the chorion with their mandibles. The larvae spin silken sheets under which they live and eat algae and silt. Tracheal gills appear first in the second instar and become more numerous with each molt. They lay a silken strand when moving outside the silken sheet which sometimes enables them to get back on the rock if they are swept off.

Five instars are found in the first generation, the first and last instars having unique characteristics. The last instar usually forms a new silken sheet with a semicircular slit at one end and small, round openings around the periphery. The larva then forms a cocoon and pupates. Oxygen is obtained by two pairs of protruding abdominal spiracles which are in contact with a gas bubble trapped in a reinforced, arched dome of the silken sheet.

The adult then emerges through the semicircular slit and rises to the surface and flies away. The total time from egg to egg is approximately fifty days.

Ginglymia acrirostris Towns. has been found in Ohio, New York, and Michigan, and is parasitoid only on Cataclysta fulicalis. The adults feed on nectar and probably copulate on exposed rocks as the females emerge from the running water. In the laboratory the females oviposit on moist paper, and the larva hatch immediately. Under field conditions they probably larviposit on exposed rocks in the rapids.

The larvae crawl under water and invade medium- to large-sized caterpillars. Three larval instars are found in the host's body cavity, the last instar having two distinct phases. In the first phase it has no externally visible posterior spiracles, but a posterior anus; while the second phase has bifurcated spiracles located dorsally about a third of the total length from the posterior end and an anus located dorsoanterior from its previous position. This last phase distends the middle segments of the mature caterpillar. The posterior spiracles are thrust through the dorsal exoskeleton of the host between the fourth and fifth abdominal segments and are in contact with the previously mentioned gas bubble trapped in the silken sheet. Increased pressure of the body fluids probably accounts for the popping out of the posterior spiracles and the enlargement of the posterior ventral segments. Apparently the shift in position of the anus and spiracles occurs because the posterior ventral segments are more movable than the posterior dorsal segments. The host is dead at this stage.

A puparium is then formed, followed by a prepupal instar and pupa. The adult, facing the same direction as the host, emerges through the puparium, moves through the semicircular slit in the silken sheet, and floats to the water surface. The parasitoid has at the most three generations a year.

63 pages. $1.00. Mic 56-948

THE BIOLOGY AND CONTROL OF THE EUROPEAN PINE SHOOT MOTH

(Publication No. 15,862)

William Eldon Miller, Ph.D.
The Ohio State University, 1955

The European pine shoot moth is the prime insect menace to red pine in northern Ohio. Injury is inflicted by the severing of needles and the excavation of buds and shoots, thereby causing deformity. Although red pine is injured most severely, Swiss mountain and Scotch pine are attacked also. The results of laboratory and field studies made in Ohio during the four seasons from 1950 through 1953 may be summarized as follows.

Eggs are deposited during the latter half of June and the fore part of July, and hatch in about nine days. Newly hatched larvae wander over the shoot for several hours and then feed at the base of needles. Later they feed in buds. The larvae live over winter primarily in the fourth instar and resume activity during April, when one or more new buds are attacked. Shoots are tunnelled as they develop. Pupation takes place in larval tunnels during late May and early June. Moths emerge primarily during the last three weeks of June.

Larval mortalities of 65 to 85 per cent commonly occur. Extremely low winter temperatures only temporarily depress the population. A number of larval parasites attack the European pine shoot moth, but none have occurred in sufficient numbers to reduce the host population significantly.

Other moths that attack pine tips and shoots in Ohio and might be mistaken for the European pine shoot moth are: Rhyacionia regidana (Fernald), Petrova virginiana (Busck), Petrova sp. (an undescribed species), and Dioryctria zimmermani (Grote).

In control experiments carried on during four seasons, sprays appeared to be more effective than dusts. Best results were obtained when sprays were applied with power ground equipment. One application of DDT at rates of one or two pounds of toxicant per 100 gallons resulted in excellent control if applied in mid-April when larval activity was resumed or in late June or early July when eggs were hatching. Sprays and dusts applied by airplane were inadequate. Red pine plantations that grow normally reach a stage in which the European pine shoot moth is no longer a matter of concern in seven to nine years. The number of sprays needed to control the insect during this period may vary from one to five, depending on the efficiency of the operation and the sources of reinfestation.

54 pages. $1.00. Mic 56-949

FIBRIN FORMATION IN CRUSTACEA

(Publication No. 14,732)

Walter Howard Rothman, Ph.D.
The University of Wisconsin, 1955

Supervisor: Associate Professor Peter R. Morrison

Among the invertebrates blood clotting is found in only a few groups, for in most forms agglutination and /or vasoconstriction acts as the hemostatic mechanism. A clot forms due to the action of a cellular "coagulin" on plasma fibrinogen in the presence of calcium. This study was concerned with the quantitative analysis of this reaction in terms of initial gelation (clotting time) and the course of polymerization (reaction kinetics) in Homarus americanus, Libinia canaliculata, Callinectes sapidus, and Cancer borealis.

A broad clotting time optimum for calcium was found between 0.02 M and 0.2 thus including the normal blood calcium level. Analysis of citrate interrupted clotting showed that calcium was needed for complete conversion. However, once clotting had started, some additional conversion could occur after citrate was added, indicating that free calcium was not needed in the final polymerization step.

Clotting time was prolonged below a pH of 6.7 and above a pH of 7.7. At a high pH value the prolonged clotting may be due to negative interaction of the more highly charged molecules. At low pH an increased interaction was expected due to a decrease in net charge, and the observed retardation must be due to covering of a specific side group, probably the imadazole group of histidine, as is also observed in vertebrate clotting.

There was an increased clotting time at low ionic strength. This might represent a negative interaction between molecules. This was surpressed by the ionic cloud at higher salt concentration. At ionic strengths below 0.4, the rate of fibrin formation (as reciprocal clotting time) was directly proportional to ionic strength. Above 0.4 there was little change in clotting time until 0.90 where salting out of protein occurs.

Analysis of the first order reaction curves showed a temperature dependent initial phase. The effect of temperature on 50% time and clotting time was identical between 0°C. and 25°C., indicating that temperature affects initial gelation and continued fibrin formation in a similar manner. Computation of the activation energies from reciprocal clotting time, reciprocal 50% time, and rate constant gave values of 16,^{000} - 17,^{000} calories per mole.

A fivefold change in the fibrinogen concentration above 5 g./1. did not markedly change the clotting time, and the rate of fibrin formation in this range was directly proportional to fibrinogen concentration, i.e., the fractional conversion for these concentrations was identical. At fibrinogen concentrations below 5 g./1., the clotting times were roughly proportional to the square of the fibrinogen concentration.

At coagulin concentrations between 2.5 - 25.0 u./cc. the clotting times only varied 10%, and the rate of fibrin formation was also substantially independent of coagulin concentration. With coagulin levels below 2.5 u./cc. the clotting times were prolonged, and the rates of fibrin formation decreased markedly, roughly in proportion to the square of the coagulin concentration.

When whole cells were added to the reactants, the clotting time decreased and the rate of fibrin formation increased markedly. With increasing amounts of cells, the initial order of reaction changed from first to second, indicating that the cell factor acted to speed the unimolecular reaction.

There was no absolute specificity of the coagulin extracts because the clotting times for all manner of crosses were identical. But there was a distinct relative specificity in terms of the initial rate of fibrin formation and in the stability of the resultant clot for the four species. Libinia

and Homarus, and Callinectes and Cancer appeared similar, while Homarus and Cancer were the most widely separated. 160 pages. $2.00. Mic 56-950

THE ECOLOGY AND POPULATION DYNAMICS OF THE BROWN LEMMING (LEMMUS TRIMUCRONATUS) AT POINT BARROW, ALASKA

(Publication No. 14,973)

Daniel Quale Thompson, Ph.D.
University of Missouri, 1955

Supervisor: Dr. William H. Elder

Field studies of the ecology and population dynamics of the brown lemming were conducted at the Arctic Research Laboratory, Point Barrow, Alaska during summers from 1950 through 1954. Lemmings were in a phase of population low in 1950; population recovery began in the fall of 1951 and reached a peak in the spring of 1953. Population decline began in June of 1953 and the lemmings returned to low densities as this study closed in the summer of 1954.

In reproduction, growth and development the brown lemming was found to be very similar to Microtus. The home range of female lemmings was found to be restricted to about one-fourth acre around the home burrow; males moved over much larger ranges. Lemmings showed a strong tendency to seek the protection of local microrelief from weather and perhaps avian predators, indicating a close adjustment of this species to the polygonal earth habitat.

Changes in age structure showed that the lemming population completely replaced itself from one summer to the next. Adult animals dominated the population in early June, but were almost completely replaced by summer born juveniles by the end of August. Adult males disappeared from the summer population at a greater rate than did adult females. An analysis of the sex and age composition of lemmings taken by snowy owls indicated that selective predation accounted for part of this differential mortality. The larger home ranges and greater activity of males probably accounted for their vulnerability.

Adults made weight gains of 10 grams in the first month of the green season and lost 5 grams at the end of this season. These changes were probably due to shifts in water content in the forage and attendant changes in water balance by the lemmings. The mean weights of adult lemmings in the summers of population low were 20 per cent less than in the summers of population high. Juveniles did not show the seasonal or annual weight changes observed in adults.

The forage did not fully recover from the heavy utilization of 1949 until two years had elapsed without appreciable lemming use. The lemmings then showed a prompt increase (in the summer of 1951) following this forage recovery. Evidence from exclosures constructed in 1950 showed that standing forage was nearly 100 per cent clipped by the lemmings as they attained the population peak in 1953.

The subsequent reproductive failure in the lemming population seems related to the inability of the brown lemming to meet the physiological demands of both heat production and reproduction on a depleted range. The reproductive pattern of the brown lemming showed marked seasonal and annual changes from 1951 to 1954. Winter breeding occurred only in 1951-52 and 1952-53 — during the upswing of the recent cycle.

A mass emigration of lemmings occurred at the peak of the recent cycle; but was not of sufficient magnitude to be significant as a means of relief from overpopulation.

Predation by pomarine jaegers in the summer and by least weasels in the winter was the most important source of mortality in the recent lemming decline. It is proposed that lemming populations at Barrow fluctuate as a self-perpetuating cycle in which lemming reproduction is conditioned by forage levels and mortality by predator levels. Successful reproduction in predators is in turn dependent upon lemming densities. 150 pages. $1.88. Mic 56-951

THE BIOLOGY OF THE NEARCTIC SPIDER WASPS (HYMENOPTERA, POMPILIDAE)

(Publication No. 15,511)

Carl Masaru Yoshimoto, Ph.D.
Cornell University, 1955

The pompilids or spider wasps are morphologically and ethologically a very distinct family of aculeate Hymenoptera. The family has a world wide distribution particularly in the warm regions; 246 species and subspecies are known from the Nearctic region.

During the summers of 1952-4, the nesting behavior of about 40 species of pompilids was observed in various habitats at Ithaca and Port Ontario, N.Y., and at several localities in the states of Florida and Kansas. The data gathered have been supplemented in the text by the published observations of other investigators, particularly the Peckhams, the Raus, Williams, Evans, and Krombein.

On almost any clear and warm summer day, one can observe spider wasps around homes, gardens, beaches, woods, sand dunes, deserts, and fields, either walking hurriedly or searching feverishly with the antennae tapping on the ground. The pompilids generally hunt for spiders on grass, on foliage, under stones, in sand, in the hidden retreat of the spider itself, under logs, or in any other place of concealment which might harbor a spider. The spider is captured and paralyzed by stinging; it is then transported to a nesting area or to a ready made nest. The spider is placed in a cell and a single egg is laid on the abdomen. All pompilids lay their egg on the abdomen of the spider except the members of the genus Ceropales, which lay their egg in the booklung of the spider. The majority of pompilids construct a simple burrow with an enlarged terminal cell in the ground; some do not make a nest, while others make nests in burrows in wood, in crevices in the ground, in animal burrows, or of mud. The egg generally takes two days to hatch into a larva; the larva consumes the entire spider within three to seven days depending on the species and the temperature and moisture content of the cell. The larva, upon consuming all of its food, spins a cocoon of silk.

There are several predators and parasites of the pompilid wasps. Among the predators are ants and beetles that steal the prey spider; the wasps themselves are preyed upon by asilid flies. Among the parasites, the miltogrammine

flies are commonly associated with species of wasps that construct their nest in the sand. The flies are known to larviposit on the paralyzed spider or at the entrance of the nest.

An attempt has been made to analyze the mechanism of behavior of the pompilid wasps. The hierarchical system of Tinbergen (1942) has been used in outlining the elements of behavior. The nesting activity of a pompilid wasp is believed to be motivated by a major oviposition instinct. This oviposition instinct in turn motivates certain instincts of the second level; these include the highly stereotyped activities of stinging, preparation of nest, and nest closure. Instincts of the third level, which are of a more plastic nature, include hunting and prey transportation.

On the basis of the relative simplicity or complexity of their behavior patterns, the pompilids may be placed in three groups: primitive, basic, and specialized. Examples are given of each, and an index of specialization is presented for each genus. Two highly specialized types of behavior, cleptoparasitism and parasitoidism, are also discussed. Generally speaking, there is close correlation between degree of ethological specialization and degree of morphological specialization.

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